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Handsomely bound volumes of THE ELECTRICAL WORLD *for* 1884 *are now ready, and will be sent, charges prepaid, to any address on receipt of* $5.00.

ELECTRICIANS the most famous—Edison, Brush, Weston, Thomson—may as well hide their diminished heads. The greatest electrician of the age is Senator James Daly, of the New York Legislature, father of underground wire bills. He knows "all about it."

THE electrical transmission of energy continues to excite great interest in this city, where there appears to be every likelihood that electric locomotives will be running in a week or two. We have during the past nine months paid great attention to this subject generally in our series of articles on electric railways, to which we would refer readers who seek specific information on the practical side of it, and in to-day's issue we give the first of some mathematical articles on the questions involved. Mr. W. Schlesinger, the writer of them, has made the electrical transmission of energy a special study for some time past, and what he has to say will therefore be found useful by many at this juncture.

THE discussion touching the unhealthiness of turning up the streets all over the city for underground wire laying is continued in the papers, but no new points are urged. The general conviction now is the one expressed two weeks ago by Dr. Norvin Green, namely, that the law will be changed before the time fixed for the work expires, and that if it were enforced there would be a very serious reduction in the telegraphic and telephonic facilities now enjoyed by the public.

MR. CYRUS W. FIELD, having completed fifty years of active life in the commercial world, retires from it this month, and will no longer participate in the management of the large corporations with which his name has been connected. It is stated that he retains his Western Union stock and that of other enterprises of a like character. It will always stand to Mr. Field's credit that he was the pioneer in laying cables across the Atlantic, and it may yet be told of him that he took a prominent part in the introduction of electric motors on the elevated roads of New York. These things will cause his name to be remembered with respect, if not with much affection.

SOMETIMES the firemen complain that they are delayed by the aerial wires in getting at fires, but we have ventured to urge mildly in behalf of the poor abused wires and poles that now and again they serve as life escapes. A case in point occurred last week at Halifax, N. S. Seven fishermen were asleep in the upper part of a boarding-house there when it was found to be on fire, and they succeeded in escaping by means of a tall telephone pole, to an arm of which they jumped from a window, sliding thence to the ground. The fire was in full blast, no other way of escape was open, and but for the pole they must have perished. We call special attention to this little incident simply with the object of giving the pole its due.

A CURIOUS accident, due to an escape of that safe illuminant, gas, is reported from Wilkesbarre, Penn. Four persons there, in one house, were overcome by the fumes of gas, and when found by the neighbors were almost beyond resuscitation. They were all in the basement of the house. The accident was caused by the breaking of a main on the street in front of the house. The gas penetrated the soft earth, made its way into the cellar and reached its victims in the basement. Significant as this little episode is, it barely gets mention in the papers that would have found columns to spare for a vivid description and the denunciation of aerial wires had an electric lighting current been the cause of shock to some of the people for whose benefit notices warning them not to "monkey with the saw" have to be put up.

AT the present time, the various Legislatures in the country are devoting considerable attention to telegraph and telephone interests, and though it would be hasty to accuse every one of the State legislators of being anxious only to "make a strike," it is safe to say that all this meddling interference can have but one result—injury to the public. We question very much the constitutionality of some of these laws fixing telephone rates and charges, and compelling exchanges to do this, that and the other thing, without sufficient compensation, and we shall not be surprised to see issue raised in the courts. It is easy enough to legislate that the charge for a telephone shall not be more than ten dollars a year, or that "there shall be seven halfpenny loaves sold for a penny," or that "the three-hooped pot shall have ten hoops;" but it is not so easy to carry that kind of legislation into effect.

HAVE cable roads already had their day? We find Col. Martin, the engineer-in-chief of the Brooklyn Bridge, contemplating with confidence the abandonment of the cable system there and the increase of traffic that must be the inevitable result of the adoption of electricity for propelling the cars. Meantime official reports of the most damaging character come from Philadelphia, where large sums of money have been spent on a cable road that will not work. Affidavits from some of the leading citizens and scientific men in that city show that the cable conduits are nothing better than open sewers, and that the system itself is, so far, an utter failure. The climatic conditions and the construction of the streets are so much alike in New York and Philadelphia that it is safe to assume that the failure of cable roads in the one city would be matched by a similar experience in the other. Whether for the street cars, the elevated roads, or the bridge, electricity, stored or used directly from the dynamos, is the only satisfactory form of energy.

TWO gentlemen in Philadelphia, Messrs. Hathaway and Linville, have brought out a new apparatus for telegraphing, in regard to which some most extravagant claims are made by the newspapers. It is claimed that this machine renders telegraphy as simple as operating a writing-machine, and promises to revolutionize the telegraph business, doing away with the expert telegrapher, as any one who can operate an ordinary type-writer can send messages. It is like a type-writer, the letters and numerals standing up on elevated keys. The keys start variously graduated currents of electricity which traverse the connecting wire, some meeting and passing in opposite directions. The touching of a key produces a letter on the paper of both the sending and receiving instruments, for both are alike. Each machine serves for either use, and can be worked as fast as a skillful type-writer operator can touch the keys. The message cannot be read by sound. It is applicable to any system of wire communication and capable of working with any number of tributaries. A company has been formed in Philadelphia to control the patents. So far as the details published go, we see nothing very new in the contrivance, and we are very far from believing that the day of the expert telegrapher has gone by. Further information is awaited with interest, but the operators can rest assured that they are not going to be wiped out by a machine any more than stenographers are. Delicate apparatus, transmitting important messages, will always require the care of skilled intelligence, and if there be any change now it will be in the direction of enlarging the area of employment for operators.

IT has been suggested that the science and art societies of New York shall combine to secure a permanent, handsome and fire-proof structure wherein to place the valuable libraries, models, specimens and works of art which are rapidly accumulating here, and all of which are exposed to destruction by fire. No one society is rich enough to do this, but a combination of all could surely accomplish it, and all would be gainers. Combined action in this matter would lead to most important results and contribute greatly to the advancement of science and art, and tend to the establishment of a desire for friendly co-operation and mutual improvement. It is no longer possible that an Angelo should be at once the greatest architect, sculptor, painter and engineer, yet it is certain that some acquaintance with the whole range of the fine arts and constructive science is essential to the complete equipment of the engineer, architect or artist. Therefore, there ought to be not only a safe home for library, specimen and model, not only convenient and accessible business offices and meeting rooms, but in addition to these some common ground upon which all may meet for professional and social intercourse, where the attrition of differently instructed minds may create fresh thought and new ambition and stimulate to higher achievement. A great auditorium for annual meetings and special occasions ought to be provided. No doubt one of the rich estates might be tempted to erect a stately and splendid home for all the societies, if they will unite in a permanent lease. It is understood that the Engineering Societies have taken the matter up and will, in due time, invite the co-operation of all societies having similar objects. We heartily commend the undertaking and hope to see it realized on a scale commensurate with its importance.

IN a newspaper interview Mr. C. E. Chinnock, of the Edison station, in Pearl street, this city, is represented as making a general survey of the advance of electrical applications and the great increase in electric lighting. One good point brought out and emphasized by him is the rapidity with which improvements are being made and adopted: "When this station was established three years ago," he said, "nothing of the kind had ever been done, and when the Edison Company establishes another station it will be very different from this, because experience has taught us many things. The arrangement of the machinery, the size of the engines and dynamos, and the space occupied by the station would be different. Our premises here are fifty feet by eighty, but half as much space would be ample were the station to be equipped anew. Undoubtedly the projectors of the system of electric motors for the elevated railways will have to learn much by experience, but they will have the benefit of the practical demonstrations of this station in arranging the 'plant' required to furnish the electricity to move their trains." Many of our readers know only too well how great was the amount of haphazard guesswork in the early installations, when there were no precedents to guide them and the conditions to be studied and met were all strangely novel. Even to-day there is little uniformity in operating stations, such that it might be spoken of as we speak of "steam engine practice," and while the experience gathered up in the five years is of incalculable value, it has yet to be methodized and made common property. The great ends to be sought are now fairly well known, but the means are still the most diverse and inharmonious. Probably if the "old" electric light stations were all rebuilt and reinstalled to-morrow they would be improved out of recognition, but the new arrangements would still be widely variant in their details, altogether beyond the differences natural to the systems adopted. All the change that is going on is, however, of the nature of gain. Every improvement seems to carry with it an economy as well as increased efficiency, and no men are more anxious for the later developments, none quicker to apply them, than the pioneers on whose toilsome, patient, empirical effort the electric lighting business of to-day is almost wholly founded.

On Electrical Transmission of Energy.

BY W. M. SCHLESINGER.

Transmission of energy from one place to another has always been of the greatest importance. It is, therefore, quite natural that the new system which only recently has been added to those in use ever so long, should have drawn so much attention to it; and, though hardly 20 years old, though the last word has not been said on the subject, transmission of energy by means of electricity has been brought to such a state that in many cases it can not only compete with advantage with the other older systems, but also show great superiority over them. There are many cases, too, in which, owing to peculiar features of the old systems, power had to be produced at great disadvantage in places to which it now can be conveyed with more economy by means of the electric current.

The questions which scientific as well as practical men had to answer are the following four:

1. Can electricity be used with advantage to convey energy from one place to another?

2. What is its efficiency as compared with that of other systems?

3. To what use is it above all adapted?

4. In which cases would distribution of energy by means of electricity from one central point be of more advantage than the production of power at the places of consumption?

Of these questions, without doubt the most prominent just now is the fourth, as it includes the problem of distributing power from one central station to a number of moving cars. Hence, in the following article I will try to show why the new system of transmission is especially adapted to this problem, and how our present knowledge of the system, practical as well as theoretical, has already insured a practical solution of it.

But to be able to do this, a thorough knowledge of the whole system is necessary; its peculiar features must be studied, and the sources of loss of energy must be known. I will, therefore, in as few words as is possible give its theory and explain the use of the formulas.

To convey energy by means of electricity from one place to another, three things are necessary: a generator, a motor and two conductors connecting both. The generator converts energy out of its mechanical form (or chemical, caloric) into electric energy; the motor reconverts it into its mechanical (chemical, caloric) form. But not all the electric energy produced by the generator will be reconverted by the motor, as it is a well-known fact that if a current pass through a circuit a certain amount of its energy will appear as heat, as no circuit can be made without resistance. If then W stand for the work done by the generator, w for that done by the motor, and if HJ be the mechanical value of the heat generated (J stands for Joule's equivalent), then, according to the law of conservation of energy first enunciated by Helmholtz:

$$W = HJ + w. \qquad \text{(I).}$$

Now, if the electromotive force of the generator be E, the resistance of the circuit, including generator, motor and conductors be R, then a current C would have to pass through the circuit, and, according to Ohm's law,

$$C = \frac{E}{R}.$$

And this is also the case as long as the motor stands still; but as soon as its armature rotates, *i. e.*, the motor does work, the current C sinks to C_1. Now, as no new resistance has been added to the circuit, the cause of this falling of current can only be an electromotive force, induced by the magnets of the motor in the rotating coils of the armature, and opposing the electromotive force of the generator. C_1 can therefore be expressed by the formula:

$$C_1 = \frac{E - e}{R} \qquad \text{(II.)}$$

in which e stands for the counter electromotive force.

In the preceding and following I assume the generator and motor to be such as to convert mechanical energy into electric, and vice versa, without loss; the sources and effect of such loss will be considered later on.

Formula II. may also be written in the following manner:

$$E = e + C_1 R.$$

or
$$E C_1 = e C_1 + C_1^2 R. \qquad \text{(III.)}$$

But the work done by a dynamo can be expressed by the product of its electromotive force and the current it generates, and, according to Joule, the heat generated in a circuit is proportional to the square of the current passing through it and to its resistance. We can therefore put

$$W = E C_1, \text{ and } HJ = C_1^2 R.$$

Equation III. can then be written

$$W = e C_1 + HJ.$$

On comparing this with I. we get:

$$e C_1 = w. \qquad \text{(IV.)}$$

or the work done by the motor is equal to the product of the current flowing through the circuit and the counter electromotive force the motor has set up.

Referring to II., we find that if E and R be constant, C_1 is a function of e, for any change of e produces a change of C_1. Now, as $C_1\ e$ is the expression for the work done by the motor, the question is, for what current will $C_1\ e$ be a maximum? To find this maximum, we will write III.:

$$e C_1 = E C_1 - C_1^2 R;$$

then
$$\frac{d\, e C_1}{d C_1} = E - 2 R C_1 = 0,$$

or
$$E = 2 R C_1;$$

but, according to I., $E = R C$,

therefore
$$C_1 = \frac{C}{2},$$

and as
$$C_1 = \frac{E - e}{R} = \frac{C}{2}$$

$$E - e = \frac{1}{2} R C = \frac{1}{2} E$$

$$e = \frac{1}{2} E.$$

That is, if the counter electromotive force is such that the current flowing through the circuit is just one-half of the

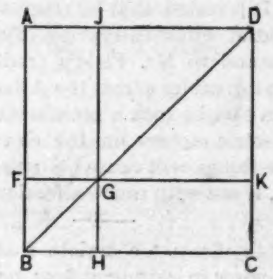


FIG. 1.

current which would flow through it if the motor did no work, the motor will be doing most work *for unit time*; for any other current larger or smaller than $\frac{C}{2}$ the amount of work done within unit time will be less.

This law, generally called the law of maximum activity, was found by Jacobi. Although it has *nothing whatever to do with the efficiency of transmission*, it has often been mistaken for the law governing the latter; and as in case of maximum activity the efficiency of transmission is 50 per cent., it has been said that the highest efficiency of the system is only 50 per cent. This is entirely wrong, as the efficiency can be made as high as one likes. This will be seen later on.

Jacobi's law can easily be proved by an example. Let $E = 100$; $R = 10$; then $C = 10$, and for $C_1 = 5$ the work done by the generator is $E C_1 = 500$ watts, the work done by the motor is $e C_1 = 250$. If $C_1 = 6$, then

$$E - e = R C_1,$$

or
$$100 - e = 60; \text{ ergo, } e = 40;$$

$$E C_1 = 600,\ e C_1 = 240.$$

If
$$C_1 = 4,\ e = 100 - 40 = 60,$$

and
$$E C_1 = 400,\ e C_1 = 240.$$

(This also proves what has been said about the efficiency, as in the first case $\eta = \frac{250}{500} = \frac{1}{2}$; in the second $\eta\ \frac{240}{600} = \frac{2}{5}$, and in the case $\eta = \frac{240}{400} = \frac{3}{5}$.)

In his book on dynamo-electric machinery, S. P. Thompson has given diagrams to show this law graphically. Our equation II. is

$$C_1 = \frac{E - e}{R}$$

and
$$E C_1 = W_1,\ e C_1 = w;$$

we can then write

$$W = \frac{E(E - e)}{R} \text{ and } w = e\,\frac{(E - e)}{R}$$

and as R is a constant we get

$$W = E(E - e) \text{ and } w = e(E - e).$$

Let us now construct a square at $A\ B\ C\ D$, Fig. 1, the side

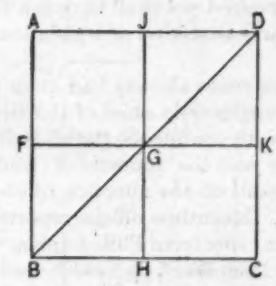


FIG. 2.

of which is equal to E, and measure out from the point B the counter electromotive force $e = B\,F$, draw $F\,K$ parallel to $B\,C$ and through the point G, in which $F\,K$ intersects the diagonal $B\,D$, draw $J\,H$ parallel to $B\,A$. The rectangle $A\,F\,K\,D$ will now represent the work done by the generator, as $A\,F = E - e$ and $F\,K = E$, and the rectangle $G\,H\,C\,K$ represents the work absorbed by the motor, as $G\,H = e$ and $H\,C = E - e$.

According to a well-known geometrical law the rectangle $G\,H\,C\,K$ (Fig. 2) will be a maximum for $G\,B = G\,D$; then $B\,F = \frac{A\,B}{2}$; that is $e = \frac{E}{2}$, and as was shown above, if the counter electromotive force is half the electromotive force, the current passing through the circuit is one-half of the current which would pass if the motor were standing still. The square $G\,H\,C\,K$ representing w is

$$G\,H\,C\,K = w = e(E - e) = \left(\frac{E}{2}\right)^2 = \frac{1}{4} E^2$$

The rectangle $A\,F\,K\,S$ represents W or

$$A\,F\,K\,D = W = E(E - e) = \frac{1}{2} E^2 = 2\,w$$

According to this diagram, then, the motor will do most work in unit time when the counter electromotive force is one-half of the electromotive force, the current at the same time being one-half of the current which would flow through the circuit if the motor were standing still.

Strange Dealing in Mutual Union Telegraph Stock.

A remarkably sharp trick was brought to light this week on the New York Stock Exchange, whereby the confiding firms who trusted an unknown man will suffer much loss, unless an investigation undertaken by the Committee on Securities, and still unfinished, should reveal a conspiracy to defraud involving a number of members of the Exchange. About 10 days ago a man with a sharp face and sallow complexion, apparently 35 years old, giving the name of Charles H. White, visited many of the brokers and inquired as to their rules on margin transactions. The margin which he named was from 2 to 5 per cent., and few of the brokers were willing to do business on that basis. With those who were disposed to meet him he began a correspondence a few days later, dating his letters from 68 Wright street, Newark, referring to the conversation and mentioning the stock of the old Mutual Telegraph Company as that which he wished to dispose of. On Friday last he mailed certified checks to several firms. The checks were for sums ranging from $300 to $500, and each firm was ordered to sell 100 shares of the stock of the Mutual Union Telegraph Company at 17, the price then quoted. Several of the firms, before dealing with him, had taken the precaution to ascertain his financial standing, and when the agencies had reported that he had for a time lived at No. 68 Wright street, Newark, with $4,000 in bank, and was an employé of the United States Express Company, they were the more easily led into the trap alleged to have been laid. On Saturday the brokers, each of whom had received a telegram from White that he had mailed the certificate of stock, went into the board and offered the stock. It was all promptly taken by J. F. Shepard, the specialist in Mutual Union and Ohio & Mississippi.

Under the rule of the Exchange the stock was deliverable on the 13th, but none of the brokers received the promised letter with the certificate for 100 shares of Mutual Union. It then began to dawn upon them that there was some irregularity in the business, and several of them recalled the notice sent out by the company a month ago, informing the Exchange that of the old stock there was outstanding only 2,267 shares, the remainder having been converted into that of the New York Mutual Telegraph Company. Of these 2,267 shares the company reported that 450 shares were in the hands of trustees, and that not more than 800 shares were owned in New York and its vicinity. Most of those caught endeavored to borrow the stock, but could not, and at once, in their bids to get at the stock to protect themselves, the price began to advance, and at 2 o'clock had risen to 31¼ bid, no stock coming out, and the brokers, in spite of themselves, increasing their own losses the more they tried to get out of their bargain. In other words, they all found themselves short of a stock which could not be borrowed, and the price of which, if bought in under the rule, might rise to a figure governed only by the cupidity of those holding it. Under these circumstance the firms caught laid a complaint before the Committee on Securities, and at 2:14 President Simmons ordered that all dealing in the stock be suspended. This was announced from the rostrum by Chairman Mitchell, and no buying-in was enforced.

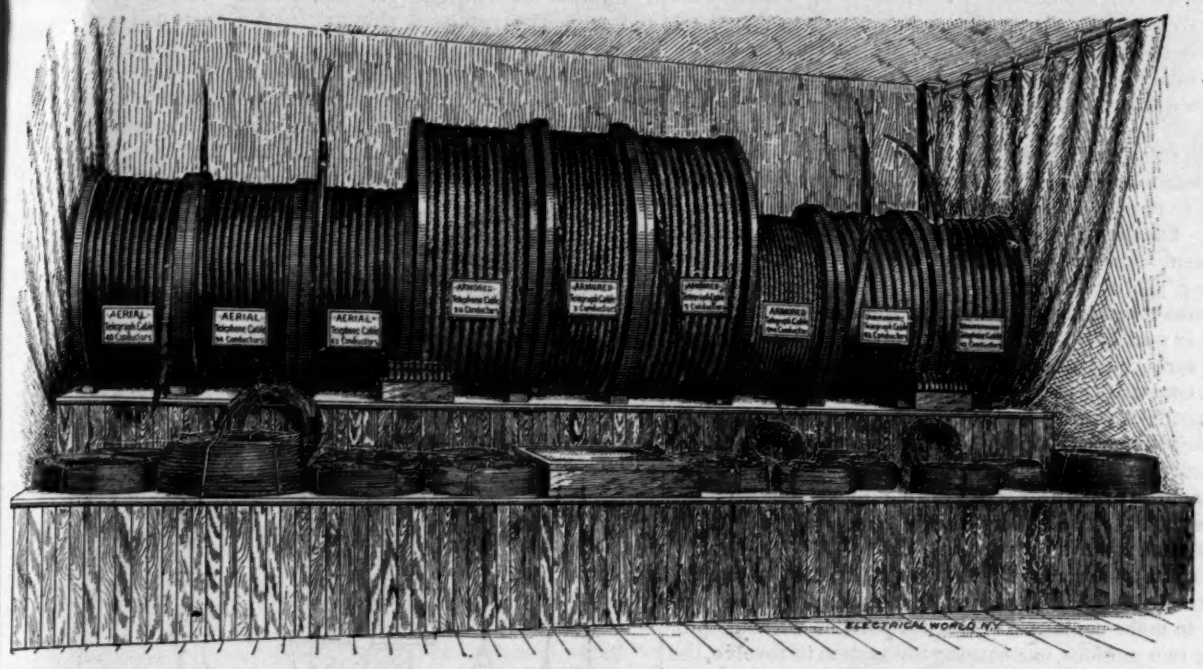
An investigation was at once ordered and the sellers of the stock and the buyer were sent for. Mr. Shepard at once informed the committee that his orders for the purchase of the stock all came in from Zimmermann & Forshay, of No. 19 Wall street. D. F. S. Forshay, when asked about the transactions, informed reporters that his orders came from a reputable firm of brokers in the street, who had put up proper margins, but declined to give any other information save that his principal was not the Newark man, White, who had given the order for the sale of the stock. Before the committee Mr. Forshay was reported by one of the nipped firms to have stated that his orders came from a city bank. This led several of the brokers to the impression that White's checks given as margins would be returned unpaid, as the bank on which they are drawn, if it gave the orders on his account for the purchase of the stock sold through the brokers, would protect itself by the funds deposited with it. The stock was offered before the close at 40, but pending the investigation none of the losing brokers could purchase it. The committee sat in council until nearly seven o'clock and then reported that no decision had been arrived at and that another meeting would take place later. The Chairman, S. T. Russell, said that the contracts would probably have to stand unless collusion was shown between the seller and a member of the board. The evidence had not shown this, but it was impossible to say what further investigation would reveal. In all about 1,500 shares of stock are now due the buyers.

J. A. Kohn, whose firm is one of those entrapped, after relating the methods employed to engage him in the business, said: "It is perfectly evident to me that White was in collusion with some member of the Stock Exchange

The thing could not have been worked if he had not such a confederate. Who it is I don't know, but our firm and the others caught will not let the matter drop until we have found out. This is necessary for the protection of the interest of every one connected with the Exchange."

Electric Cables.

It may be laid down as an axiom that successful electrical communication between two places depends primarily upon the integrity of the insulation of the connecting line. A fault in an instrument may, as a rule, be remedied in a short time, and without inconvenience; but a defective line causes delay and loss, which may vary considerably. If the line is locally defective at certain points, the remedy may be applied with comparative ease, but a line which in its very nature is liable to delay traffic is a constant source of vexation and expense. These remarks apply equally to aërial, underground and submarine lines, and ever since electric telegraphy became an accomplished fact means have been sought for obtaining lines which should be worked with the least expense and care.



KERITE-COVERED CABLES, PHILADELPHIA EXHIBITION.

Recent years have seen such enormous development in telegraph and telephone work that particular attention has been paid to the construction of cables, to take the place of wires strung on poles. These cables, both aërial and underground, require special construction to make them serviceable for different classes of work, for while the former, being strung upon poles, are easy of inspection, the others, placed under ground, are supposed to remain undisturbed in good working order for an indefinite time; while the submarine cable requires special and exacting qualities. The Philadelphia Electrical Exhibition afforded a good opportunity of studying the means employed to provide cables for the various purposes above mentioned, and among them the exhibit of cables covered with Day's kerite insulation attracted considerable attention. Our illustration represents the exhibit, which contained quite a variety of products, from the large armored submarine cable to the smallest office wire.

The underground cables shown are made with special reference to high insulating qualities and durability. They have been very extensively employed and with eminent success. Kerite possesses a high insulating power, and is not affected by outside influences, such as mineral oils and illuminating gas, while water, salt or fresh, protects it and improves its insulation.

In the city of Chicago underground cables have been used to a considerable extent, and during the past year nearly five hundred miles of telegraph wires were buried, making a total of about seven hundred miles now working successfully.

The most extensive system is that of the Bankers & Merchants' Telegraph Company, constructed during the spring and early summer of 1884 by Mr. Clark B. Hotchkiss, the kerite cable being used. The accompanying diagram will show the character of the work and the route of the cables, the main trunk lines being denoted by full and the branches by dotted lines.

The main conduit, four and one-half miles long, is of 4-inch cast-iron pipe, laid 3 feet deep, with joints calked with oakum and lead. It starts at the company's main office on Madison street, and extends west and south, connecting with the pole lines east to New York and southwest to St. Louis.

The conductors of the cables in this system are of No. 15 B. W. G. copper (about 80 pounds to the mile), insulated with kerite to an outside diameter of $\frac{7}{32}$ of an inch. The conductors are cabled together symmetrically and are covered over all with two layers of extra heavy waterproof tape, and range in capacity from five to forty conductors.

At each street intersection (and where the blocks are very long, in the centres of blocks) circular brick manholes are built, with heavy iron covers, and in these manholes, the cables are drawn in and joined. From this main line branches of 2-inch and 3-inch pipe (according to the requirements of the district) radiate to the various business centres, and cables are run through these branch lines connecting at various points with the main line conduit.

All the exchanges, principal hotels, and the centres of various branches of trade have wires running to their different localities, all worked through this system, which is one of the most extensive, complete and satisfactory thus far put down in any of our cities. One lineman only is required to attend to this service, and even he could be dispensed with were it not that in the extreme southern part of the city there are no sewers, and as a consequence no drainage is afforded for the manholes, which have on this account to be kept free of water after heavy storms or thaws. The saving of linemen's wages is an important thing, and in a service of two hundred or three hundred miles of wire, the saving will more than pay the interest on the investment in the plant. Another recommendation is the absence of repairs after heavy snow or sleet storms; and there is no loss from interruption of service consequent upon the weather, as the company has not a foot of overhead wire.

Much delay was experienced at first owing to technicalities of municipal ordinances to be complied with, but when once commenced, work was pushed and the whole system was completed in exactly four months from the day of commencement. The engineering difficulties were not a few, owing to the restrictions of the city in refusing to allow any street newly paved with Belgian blocks to be disturbed; and in one case this caused a detour of several blocks to avoid opening one street crossing. About the time of the completion of the line, Dr. W. W. Jacques, electrician of the American Bell Telephone Company, of Boston, made, in addition to the electrical tests, practical telephone tests to determine the practicability of underground telephone communication. About twelve miles of underground wire was connected together and conversation was carried on with perfect ease. Long aërial lines belonging to the local telephone company were connected to the underground line, and communication was had with Valparaiso, fifty-five miles, and Michigan City, eighty miles distant. The tests, both electrical and practical, were highly satisfactory.

A few months ago, as we noted at the time, the Western Union put down an extensive underground system in Boston, using for the purpose kerite cable, carrying no fewer than 61 conductors. Last week, the same company put down about half a mile of the same 61-conductor cable in Chicago, for use between the new Board of Trade building and their main office.

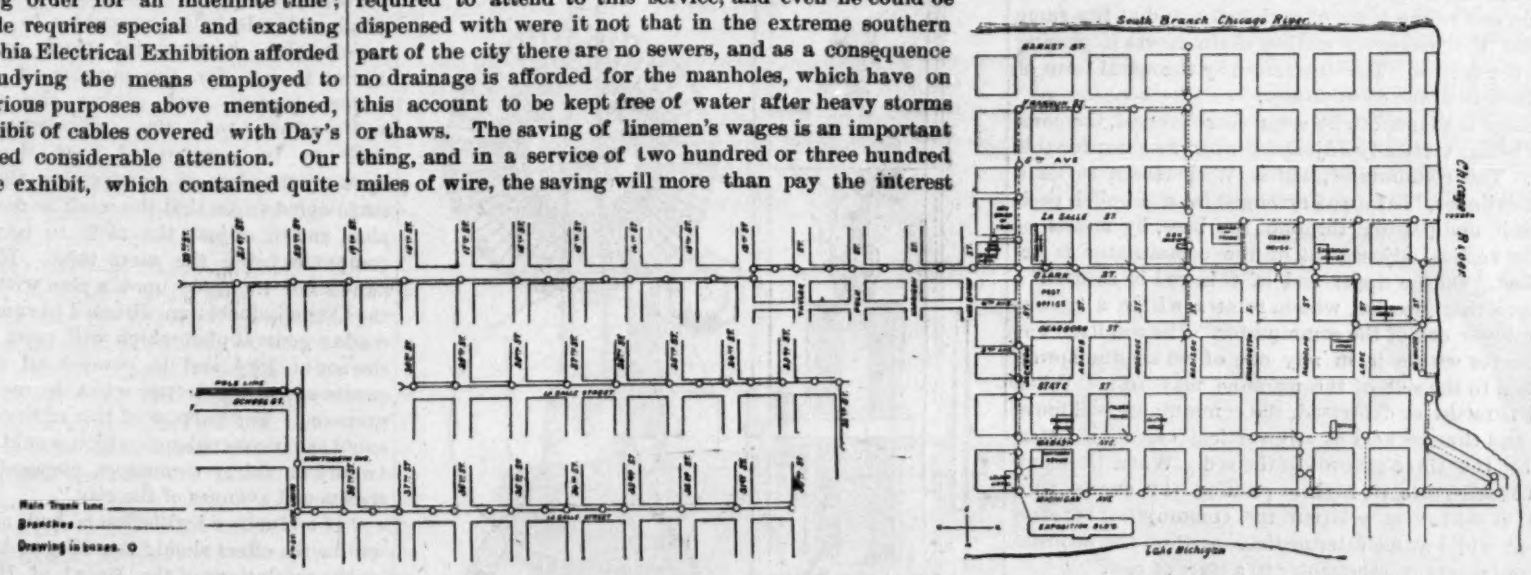


DIAGRAM OF UNDERGROUND SYSTEM IN CHICAGO.

Telephones Exported.

We give below a list of the sets of telephones exported by the Continental & Tropical American Telephone Company since it made its contract with the American Bell Telephone Company:

	Sets.
To Brazil	2,613
" Buenos Ayres	2,483
" Mexico	3,197
" West Coast South America	911
" Venezuela	635
" Cuba	592
" West Indies	488
" Spain	292
" U. S. of Colombia	222
" Central America	153
	11,586

The company supplied as well all the auxiliary apparatus and supplies necessary to put them into use.

Trade-Mark Law and the Leclanche Battery.

We publish below the decision given in a suit affecting the manufacture of Leclanché batteries in this country:

UNITED STATES CIRCUIT COURT, SOUTHERN DISTRICT OF NEW YORK.

The Leclanché Battery Co. *vs.* The Western Electric Co.

WALLACE, J.: The complainants cannot maintain their claim to the exclusive right to use either the word "Disque" or "Pile-Leclanché" as a trade-mark when applied to the batteries manufactured and sold by them. As owners of the right to manufacture and sell the Leclanché batteries until the expiration of the patent granted to Roosevelt, as the assignee of Leclanché, they have been accustomed to use the word "Disque" on the labels pasted on the glass jar which forms part of the battery, and the word "Pile-Leclanché" blown in the glass. Neither of these words are arbitrary names selected to denote the article as the production of a particular proprietor. They are appropriate, and are intended to indicate that the batteries are of a specified form and are made according to the patent of Leclanché. "Disque" describes the form of the battery, and is used to distinguish it from the prism and other forms of porous cup batteries. "Pile" is synonymous with battery, and "Pile-Leclanché" is the designation in French of Leclanché's battery.

When an article is made that was heretofore unknown, it must be christened with a name by which it can be recognized and dealt in, and the name thus given to it becomes public property, and all who deal in the article have the right to designate it by the name by which alone it is recognizable. Hostetter *vs.* Fries, 17. Fed. Rep., 620; Singer Mfg. Co. *vs.* Stanage, 6 Fed. Rep., 279. As soon as Leclanché invented his battery in France, it was necessarily given the name "Pile-Leclanché," and that name could never again be appropriated exclusively as a trade-mark even by the inventor himself.

A name alone is not a trade-mark when it is applied to

designate not the article of a particular maker or seller, but the kind or description of thing which is being sold. Singer Mfg. Co. *vs.* Loog, 15 Reporter, 538; Wheeler & Wilson Mfg. Co. *vs.* Shakespeare, 39 L. and J. Ch., 36; Young *vs.* Moore, 9 Jur, (N, S.), 322; Canal Co, *vs.* Clark, 13 Wall, 311.

The defendants have imitated the label of the complainant to the minutest details, except the signature at the bottom. The complainant is entitled to protection against the unlawful competition in trade thus engendered by the simulation of its label, and upon this ground a decree is ordered in its favor.

Chronological Record of Expiring Electric Motor Patents.—V.

[*Conclusion.*]

The principal feature of novelty in the electric motor which William Wickersham patented June 2, 1868, and shown in Fig. 26, is the employment of an endless electro-magnetic chain, the alternate links of which are magnetic bars, the remaining connecting links being non-magnetic. The magnetic links are surrounded by helices through which an electric current passes.

The machine itself has two of these endless magnetic

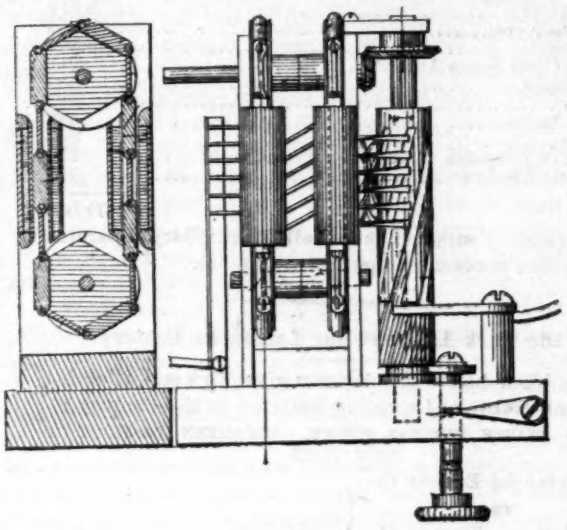


Fig. 26.

chains, arranged vertically on parallel shafts so as to revolve thereon. The bars of the chain, at fixed periods in their revolution, pass through helices having hollow cores.

The strips of metal of which the stationary helices are formed extend at one end of the motor beyond the helices, and are arranged in parallel lines. A commutator, consisting of a vertically arranged revolving cylinder, has metal conductors in the shape of strips of metal placed at intervals around it. These conductors are wound spirally, and extend from one end of the cylinder to the other. The extended ends of the helices before referred to are arranged so as to wipe this revolving commutator, and thus close the circuit successively in the different helices. The closing of the circuit in the independent series of coils which constitute the completed helices, is made successively from one end to the other of each helix, and at the same speed that the magnetic endless chain moves in passing through the helices. This is effected by the spiral form of the conductors in the commutator.

The motor is adapted to be stopped or reversed, the commutator being vertically adjustable upon its shaft for this purpose. This commutator, which Wickersham styles a "circuit-cylinder," has a rod arranged in a parallel position with it and passing through the base, by means of which the vertical adjustment of the commutator is accomplished. On the upper end of this rod is secured a freely revolving washer, which rotates within a groove near the lower end of the commutator. The rod itself has three grooves within it, in any one of which the spring stop bolted to the side of the machine may rest. When this rod is raised or depressed, the commutator will move with it and thus be held at any vertical elevation determined by the three grooves in the rod. When the commutator is moved to its highest position the engine runs forward; at its lowest position the commutator reverses the motor, while at its intermediate position the adjustable commutator brings the motor to a state of rest.

The independent coils which constitute the helices are wound in different directions, and each one conducts the electric current around the magnetic link of the endless chain in a different direction from the one preceding it, thereby giving to the magnetic links alternate reversed polarities.

Where two columns of helices are used on opposite sides of the machine (the magnetic chain passing downward through the one and upward through the other), the polarity of the former will be downward and that of the latter upward.

The motor constructed by Charles T. Mason and that made by Mr. A. J. B. De Morat complete the list of patented motors, the terms of protection of which have expired or will run out during the present year.

Mason's motor (Fig. 27) is designed for driving a fan. It consists of an electro-magnet, one terminal of the coil of which is connected to the binding post shown in the illustration, and the other to the spindle of the fan-shaft. The armature of the electro-magnet is shown pivotally secured to the fan shaft above the electro-magnet. The fan spindle also carries a cam which, as it revolves, breaks and makes connection with the horizontal wiping spring secured to a standard at the left of the figure. The cam and wiping spring form the commutator of the motor.

De Morat's motor is shown in side elevation and in vertical section in Fig. 28. De Morat asserts that there is no interruption or breaking of the current in the use of this motor, such a result never having been practically accomplished before, and that greater velocity, more regular and constant motion, with greater power, can be obtained from his construction than from any other similar machine patented before that date.

By referring to the drawing it will be seen that the lower wheel represents a circular magnet of two or more poles. The central disc of this wheel is of iron, with contiguous coils of wire on either side, the whole being clamped together with wooden discs. The commutator is also fixed upon the shaft of this circular magnet. It consists of two metal bands insulated from each other and electrically connected with two wiping springs which complete the circuit.

Above this circular magnet is a wheel of many armatures. This wheel consists of a number of radial arms which have flanges to receive the separate armatures composing the wheel. Each of these armatures has an independent radial movement within the flanges of the wheel, but without touching the circumference of the same. Each of the armatures has an inward extension stem or shank, which is held in operative position by lugs upon the wheel frame. Coiled springs surround these stems between the lugs, and have a constant tendency to force the armatures outward when not held inward by the latches.

A projecting arm is bolted to the inner side of one of the standards, on the end of which the outer ends of the latches of the armatures strike. This movement lifts the latches out of the notches in the armatures, and the springs force them outward, as shown.

As soon as the circular magnet is energized, the armatures are attracted angularly, producing a motion by the tendency to make contact. This is not possible without producing two motions, one causing the system to revolve, the other sending the armatures inward by their contact with the magnet, and fastening them there by the latches dropping into the notches on the armatures. In that position they pass beyond the magnetic field until released by the projection on the frame, as described.

De Morat contemplated reversing the relative arrangement of the motor by converting the armatures into electro-magnets and causing them to exert an attraction on different curves or on a number of planes tangent to the circle in the form of a polygon, as shown in the small sketch representing a hexagon. The attraction would then be effected so as to form on endless chain or elastic band.

Senator James Daly's Plans.

Senator James Daly, while in New York recently from Albany, was asked what he thought of the resolution

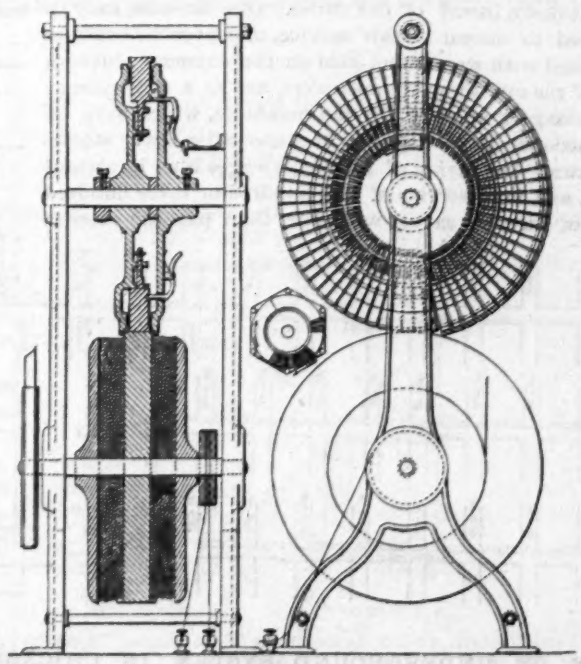


Fig. 28.

passed by the Board of Health declaring the laying of the telegraph wires underground in summer would be detrimental to the health of the city. He said:

"I have to preface my statement with the remark that I am not fighting the moneyed interests of this city in the stand I have taken in regard to this matter. But I believe that it is for the best interests of the city to compel the telegraph and telephone companies to place their unsightly wires underground. About four weeks ago I received a letter from Mr. Chittenden, a lawyer of this city, telling me that Cyrus W. Field, Jay Gould and the other big owners of the telegraph and telephone stocks were circulating a petition among physicians setting forth the danger to the public health which might result from the opening of the public streets and avenues for the laying of the telegraph wires underground, and that this whole plan was nothing but a dodge started by the telegraph companies for the purpose of defeating the consummation of the act passed last year on the subject."

"How do you propose to meet the argument of the telegraph companies based upon the resolutions of the Board of Health?"

"By the proof that these resolutions start] from entirely mistaken premises. No such thing as set forth in these resolutions is contemplated. The compliance with the act of last year does not necessitate the making of excavations in a very large number of the most densely populated streets and avenues of the city at the same time. Before the act of 1884, which is here referred to, was passed, the Legislature appointed a committee to report as to the feasibility of the plan of putting the telegraph and telephone wires under ground. I was chairman of that committee, and we then subpœnaed a number of experts, who submitted various plans and gave the result of the experience they had gathered in European countries as to the operations of these plans. It then appeared that an eight-inch tube is sufficient to carry 1,200 wires, which is more than all the telegraph and telephone wires of the whole city combined, and that a small ditch two feet wide and four feet deep, which should not be extended for a greater distance than

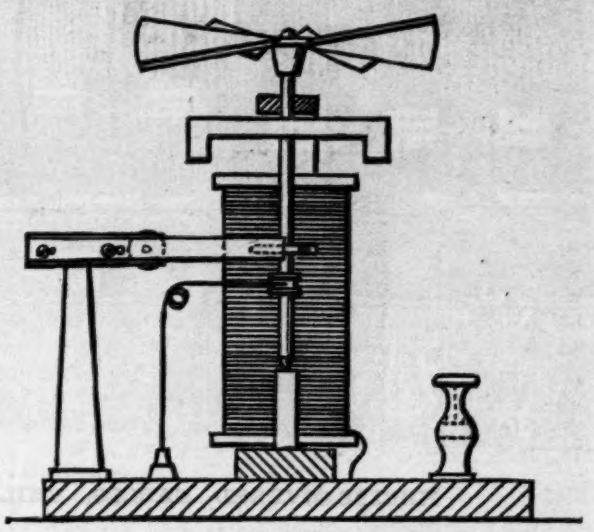


Fig. 27.

fifty feet at the utmost, at any one time, in any one street, would be sufficient for the purpose of carrying out the provisions of the proposed legislation. The charge that the execution of the act of 1884 would necessitate the tearing up of whole streets is perfectly absurd."

"But will the various telegraph and telephone companies consent to use one tube?"

"In order to enforce such consent additional legislation is required. On March 10 I introduced in the Senate a bill which is supplementary to the act of 1884, and which is made the special order for next Tuesday evening. This bill is intended to offset what I know to be the purpose and intent of the telegraph companies. It proposes to establish a temporary commission, which will be charged with the responsibility of enforcing the act of 1884, and for that purpose will be directed to notify the various telegraph and telephone companies to report within sixty days a plan showing the streets or avenues which they desire to use for the purpose of laying their wires under ground, and giving the general dimensions and course of the underground conduits desired to be constructed. If the companies agree upon a joint plan of construction the Commissioners are empowered to see that the work be done according to that plan, and to adjust the ratio to be paid by the different companies using the same tube. If the different companies fail to agree upon a plan within sixty days, then the Commissioners are directed to cause to be devised and made a general plan which will meet the requirements of the act of 1884, and to compel all individuals and companies operating electric wires to use that sub-way thus prepared. The purpose of this additional legislation is to avoid the inconvenience which would arise from having twenty or thirty companies engaged in tearing up the streets and avenues of the city."

"If no further legislation is had on the subject what will be the effect should the telegraph companies, relying on the resolutions of the Board of Health, refuse to lay their wires underground until the 1st of November next?"

"The law of 1884 makes it mandatory upon the city authorities after November 1, 1885, to proceed with the work of having the electric wires placed underground on their own account, and to cause all telegraph poles and aerial wires to be removed. But, more than that, each property holder before whose premises a telegraph pole is placed can go and cut it down, if it be not removed by November 1, 1885. I suppose the telegraph companies don't fear that, relying most likely upon their favorite remedy—an injunction. They will get into the courts with their contests and keep them there for a number of years."

The Telephone in Austria.—Funds are being raised by the Telephone Company of Austria, Limited. It owns exchanges, worked under exclusive concessions from the government, in the towns of Prague, Graz, Trieste, Lemberg, Cracow, Czernowitz, Reichenberg, Pilsen and Bielitz-Biala. The business has grown to such an extent as to demand further outlay for new construction.

The Fitchburg Steam Engine.

Steam engine practice of the last twenty years differs in so many ways from that of the preceding eighty years, that a person unacquainted with the cause would be apt to wonder at the change which comparatively few years have wrought. Dating the successful introduction of the steam engine from the time of Watt, it is true that improvements were constantly made from the very first period, but it was not until steam and the steam engine were taken up by men of science that the direction was pointed out in which improvement should be sought. It is scarcely more than forty years ago that the true principles regarding the action of heat engines were enunciated, and while improvements were made before that time they were the result more of trial and experiment than of strict reasoning. When the true path was pointed out, however, it required time to reduce the principles to practice, and thus it is that the era of modern steam-engine practice dates back but a score of years.

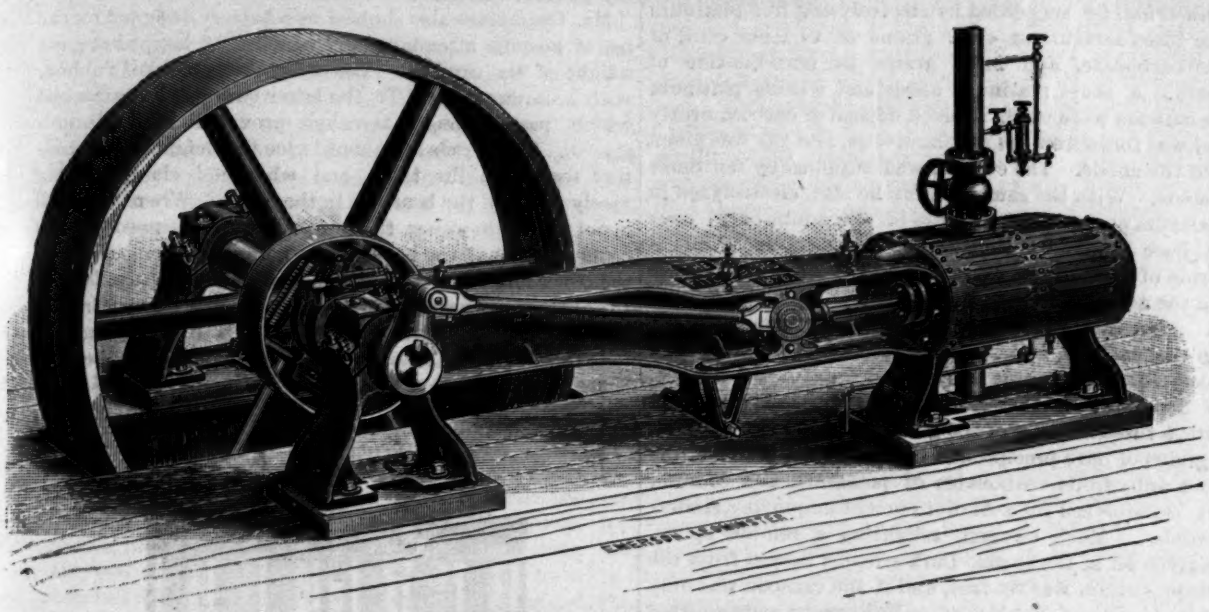


FIG. 1.—FITCHBURG ENGINE—FRONT VIEW.

To obtain the greatest amount of useful work from a given quantity of steam is the problem which the steam-engine builder bears constantly in mind, and which each one attempts to solve in his own special and peculiar way.

The engine which we illustrate to-day is of the automatic variable cut-off type, and represents the latest design built by the Fitchburg Steam Engine Company, of Fitchburg, Mass. In its general appearance, as seen in Fig. 1, the engine shows the well-known girder-frame which has proved so efficient, but it embodies a number of details of construction which give it a distinct individuality.

Recognizing the fact that one of the chief causes of loss of power in steam engines arises from cylinder condensation, the engine has been designed for a piston speed such that the time in which the steam is in contact with the cooling walls of the cylinder shall be reduced to a minimum. Added to the quick stroke, giving a piston speed of 500 to 600 feet per minute, the cylinder is carefully covered with felt, while the cylinder-heads are made with air spaces and polished outside, which effectually prevents both conduction and radiation.

The method of steam distribution exhibited in this engine resembles in principle that adopted by Corliss. In both, the admission and exhaust are effected by separate valves, but the methods employed differ distinctly. As is well known, the Corliss valves are worked from a wrist-plate to which they are not rigidly or positively connected, but at a certain point in each stroke the connection is made by a latch which is tripped, and which breaks the connection at the proper time. The valves are then brought to their original position by plungers working in dash-pots, and are then motionless until again hooked in by the latch. This method of working the valves, while most admirable in certain situations, is nevertheless unsuited to engines of higher rotative speed, for the reason that the motion of the plunger in the dash-pot is so slow that before it has reached its seat and allowed the valve to perform its full function it is again brought in connection with the wrist-plate. Under such conditions neither admission nor exhaust valves would ever be entirely closed, and economy or regulation would be out of the question.

In order, therefore, to take advantage of the benefits to be derived from this method of steam distribution, it became necessary to devise a positive valve-gear, or one which is in constant connection with the main shaft of the engine. Our illustration, Fig. 2, shows the manner in which this is accomplished. The admission valves, two in number, are mounted on independent rods, control both the steam admission and cut-off, and are placed in the upper part of the steam-chest. They are connected by a link to a rock-shaft, which receives its motion from one of the eccentrics on the main shaft.

The second valve rod, which enters the lower part of the steam-chest, carries the two valves which control the points of exhaust release and closure. They receive their motion from a rocker-arm connected with a second eccentric placed on the main shaft, and they can be adjusted so as to give any desired effect as regards release and compression. While the latter valves, once set, remain so, the admission and cut-off valves are connected to an eccentric, the position of which is controlled by a governor, and thus the engine receives an amount of steam which is proportional to the amount of work required; at the same time, its speed is kept constant.

Regulation plays such an important part in modern steam-engine practice, and is so necessary in engines designed for electric lighting, that the regulator or governor constitutes one of the principal parts, and should be specially inquired into by those interested in providing motive power.

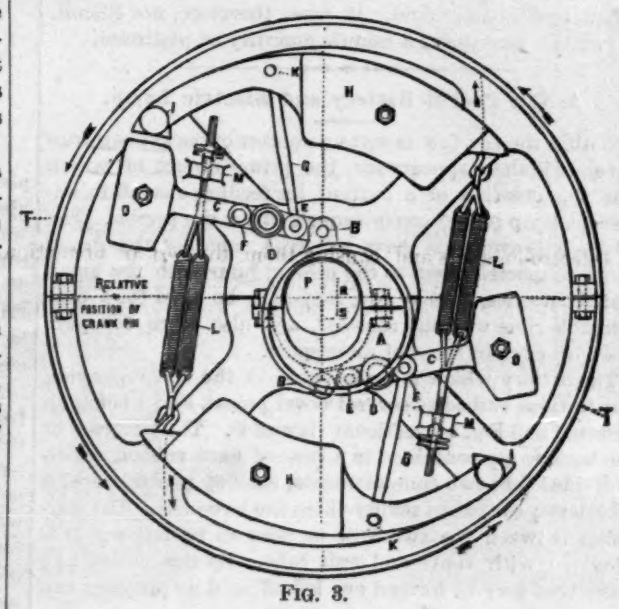


FIG. 3.

Our illustration, Fig. 3, represents the governor of the Fitchburg engine, which has been found to keep the speed constant for any change of load.

The weights O, acting over steel pins D as fulcra, exactly balance the weight of the eccentric and its strap, and in vertical engines the valve and valve rods also, leaving no work upon the governor but to shift the eccentric when the load upon the engine changes. The connecting rod G is attached to the suspension arm C at E, acting directly upon the eccentric, while the opposite rod G is attached to the opposite arm C at F, acting over the pin D as a fulcrum, moving the eccentric so that the outward motion of the centrifugal weights H is exerted with equal power in moving the eccentric in one direction across the shaft.

By simply transferring the ends of connecting rods $G\,G$ from E to F and from F to E respectively, the outward motion of the weights H throws the eccentric in the opposite direction and they are right for running the engine the other way.

The action is as follows: So long as the engine is below speed the eccentric is kept in its longest throw by the tension of the springs and steam follows ¾ of stroke, but as soon as proper speed is reached the centrifugal action of the weights H overcomes the tension of the springs and they move outward in the direction of the arrows, at the same time lengthening the springs. By means of the connecting rods $G\,G$ the outward motion of the weights turns the suspension arms $C\,C$ upon their fulcra D and through the cars B the eccentric is carried across the shaft from S toward R, and as the arcs described by the centres $B\,B$ are in opposite curves they compensate each other and the centre S of eccentric follows a straight line in its movement. This manifestly decreases the eccentricity and increases the advance of the eccentric, giving an earlier cut-off to the valve until, when the eccentric is swung squarely back of the crank, the valve does not open at all, there being all points between this and extreme cut-off for variation. Upon the least diminution of speed the springs have more power than the centrifugal force of the weights, and the motion of the parts is arrested and turned in the opposite direction, giving a later cut-off as more work is performed by the engine.

The minor details of the engine have also been attended to with care. All wearing parts, including the balanced valves, are constructed so as to allow for adjustment. The engines are built in all sizes, varying from 30 to 550 horse-power, and the large number of them in use speaks well for their economy, durability and efficiency.

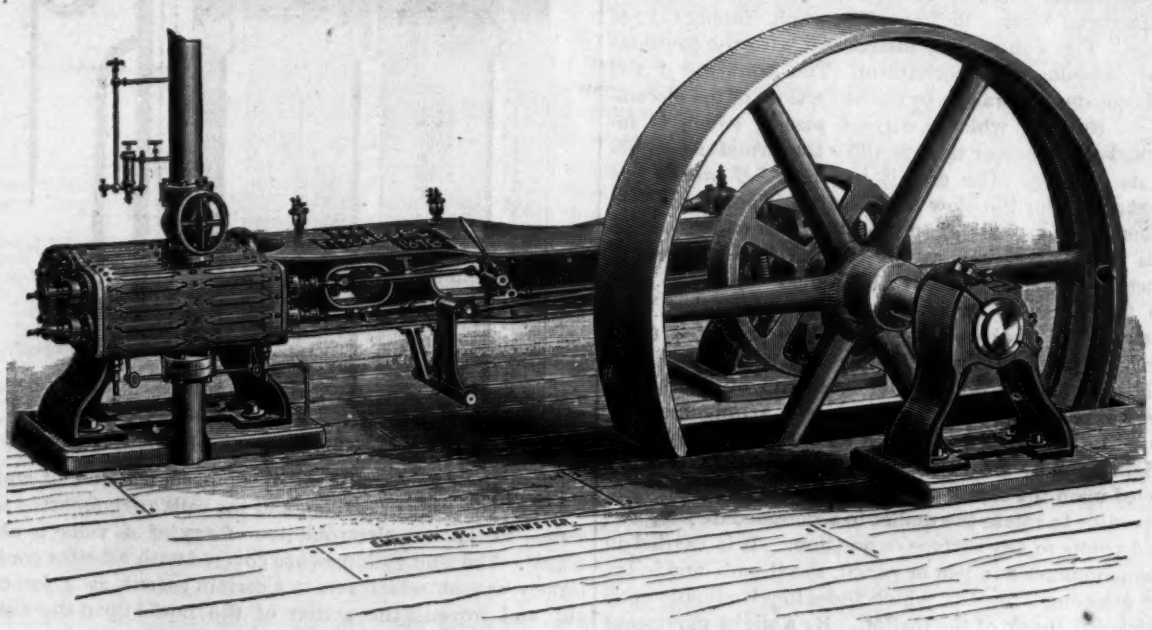


FIG. 2.—FITCHBURG ENGINE—REAR VIEW.

Connecting Light-Ships with the Shore.

The desirability of securing telegraphic communication with floating vessels moored at sea on dangerous parts of the coast has long been under the consideration of the British light-house authorities, but the difficulties opposing a successful solution of the problem proved so great that little, if anything, was done until within a short time ago.

The great difficulty has been to secure the telegraphic connection on board the ship, as the light-vessels are moored at the bow by a chain cable 1½ inches in diameter; this chain in bad weather is paid out sufficiently to allow them to swing and ride freely. Sometimes the motion is so great that the vessels describe repeated circles. Any wire connection of an ordinary character would become so inextricably twisted and tangled as soon to become totally useless. The connection would also require to be paid out whenever the mooring chains were paid out. Fouling with the ships' anchors was also another difficulty to be overcome. The problem, according to an English contemporary, was ultimately placed in the hands of the British Telegraph Construction and Maintenance Company, Limited, and a contract was entered into whereby they were to electrically connect a light vessel with the shore and maintain such communication for one year, no payment being made in the event of any failure to comply with such condition, unless the failure should arise during the working of the cable from exceptional causes for which the contractors could not fairly be held responsible. The company, after a variety of experiments, have adopted a hollow steel-wire rope, 8½ inches in circumference, formed by 14 twisted strands, to be used as a substitute for the chain mooring. The wire rope has been proved to 70 tons stress. The telegraphic cable runs through the centre of this wire rope. On board the lightship a Morse transmitter, a Wheatstone A B C and a telephone have been fixed. The light-vessel is moored in 10 fathoms at

low water, and is about 9 miles off the shore. The importance of establishing direct communication with the light-ships cannot be too highly valued, as they frequently see ships in danger several hours before the fact has been known on land. No doubt if this experimental departure in a new direction be successful, all other light-ships round the coast will be electrically connected with the shore, and there seems no reason why all light-houses should not also be in telegraphic communication with the main wires of the country. To the shipping interest this experiment will be watched with great pleasure, as the lives of many men will be saved, besides in addition effecting a saving annually of many thousands of dollars.

An Electric Dental Mallet.

There is perhaps no branch of surgical science that has drawn to greater extent upon electricity as an aid than that of oral surgery. As a subordinate branch of the latter,

FIG. 1.

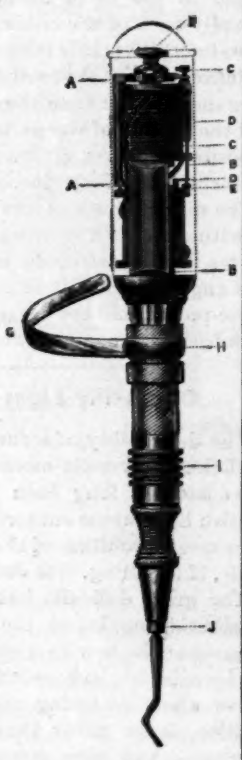


FIG. 2.

dental surgery may be said to be most developed, and it has consequently called for the largest number of appliances to facilitate its most frequent operations. We have the little electric lamp to illuminate the mouth, the galvano-cautery snare to remove abnormal growths, and the oft required dental mallet. The ramming down of the filling in the teeth requires a series of sharp blows, and as a rule the space within which to acquire the necessary velocity of the tool is quite limited. Dental mallets, actuated by electricity, have therefore come into favor, as they allow the blows to be struck in the exact spot under treatment, while their force is increased by the increased mass which is set in rapid motion.

Our illustration Fig. 1 represents such an electro-magnetic dental magnet, devised by Dr. Stansbury, and manufactured by the Railway Telegraph Supply Co., of Chicago. Fig. 2 shows the instrument with the cover removed, exposing the mechanism. The armature *A A* is kept in constant vibration by the attractions of the electro-magnets through which a current passes, which is interrupted at the proper time to allow the armature to regain its position. The circuit breaker *C E* breaks the current at *E* after the blow is given at *I*. The circuit then remains broken at *E* until the armature *A A* recoils to a position as far from the magnet as magnetic force can safely be relied upon to act, when the circuit is again closed at *E*, and another blow imparted. All the working parts are protected from external injury, dust and dirt, by the rubber shell *M*, which may be slipped off the large end of the mallet, thereby exposing to view the internal arrangement of parts. The instrument is carried upon the index finger of the right hand by means of a spiral open ring *G*, which is swiveled upon the shank of the instrument at *H*, enabling the operator to rotate the mallet to accommodate irregular shaped points to any surface or position. It is carried in the same manner as a pen or pencil, the thumb and index finger grasping a ferule *I*, which slides longitudinally upon the nickeled shank of the mallet. By a slight movement toward the head of the instrument *F*, when properly connected with the battery, automatic motion is at once established, and continues until stopped by a reverse movement of the ferule *I* breaking the circuit at *E*. Any amount of hand pressure may be applied either in combination with or independent of the magnetic blow.

An Exchange Destroyed by Fire.—On April 8, a fire broke out in the Commercial Block, Martin's Ferry, O. The telephone exchange, furniture and fittings were destroyed.

The Electro-Deposition of Carbon.

Dr. Gore, F. R. S., has been making a large number of experiments on the deposition of carbon, boron and silicon by means of the electric current. Most of these experiments resulted in failure, or comparative failure, to deposit carbon; but several were successful. For example, says *Engineering*, he succeeded by electrolyzing in a platinum cup a fused mixture of 475.2 grains of 97.1 per cent. of sodic carbonate, and 217.4 grains of boro-fluoride of sodium. A sheet platinum anode and a thick platinum wire cathode were used. A black deposit of carbon, nearly pure, was formed on the platinum wire, and gas was given off at the anode. The current was supplied by ten Smee elements. With the same current he also electrolyzed in a platinum cup a fused mixture of 300 grains of 97.1 per cent. pure potassic carbonate, and 442 grains of silico-fluoride of potassium, using similar electrodes. Gas rose from the anode, and at first gas only rose from the cathode too. After that streams of black matter poured down from the cathode, and the latter acquired a blackish film, but subsequently became alloyed and fused on the surface. The deposit was, therefore, partly or wholly silicon. Again, a fused mixture of 200 grains of pure sodic hydrate, 170 grains of pure precipitated silica, and 610 grains of the mixed anhydrous carbonates of potassium and sodium, were electrolyzed by a similar current employing similar electrodes. Much oxygen, relighting a red-hot splint, was given off at the anode. Dark streams flowed from the cathode, sodium was set free, and if the cathode was only slightly immersed, bubbles of sodium vapor were emitted and took fire at the surface of the liquid. After one hour's action the platinum anode had lost 0.37 grains in weight, and the cathode had a jet black deposit on it. This deposit was subsequently washed and dried; a portion of it burned with a glow when heated to redness on platinum, and left a minute residue of gray platinum. It also deflagrated with fused nitre below red heat, and vividly by heating with potassic chlorate. It did not dissolve nor evolve any gas in a mixture of strong nitric acid and pure concentrated hydrofluoric acid. It was, therefore, not silicon, but carbon containing a minute quantity of platinum.

A New Pocket Battery and Electric Lamp.

Within the last few months a number of pocket batteries have made their appearance, the prime object of which was the creation of a current for feeding a small incandescent lamp placed conspicuously about the person. The latest improvements have removed some of the drawbacks connected down to the present hour with the small sealed batteries, so that now they may be used for a considerable time without renewal, and also serve for purposes other than those of mere sport.

The battery which is represented in the accompanying illustrations embodies several novel points, Fig. 1 being an external and Fig. 2 a sectional view of it. The elements of the battery are contained in a case of hard rubber, which is divided into two compartments, each of which contains a battery; so that in reality there are two cells. The partition between the two will be seen to be hollow. It is provided with vents and exit tube. By this means any gases that may be formed are led off, and no pressure can

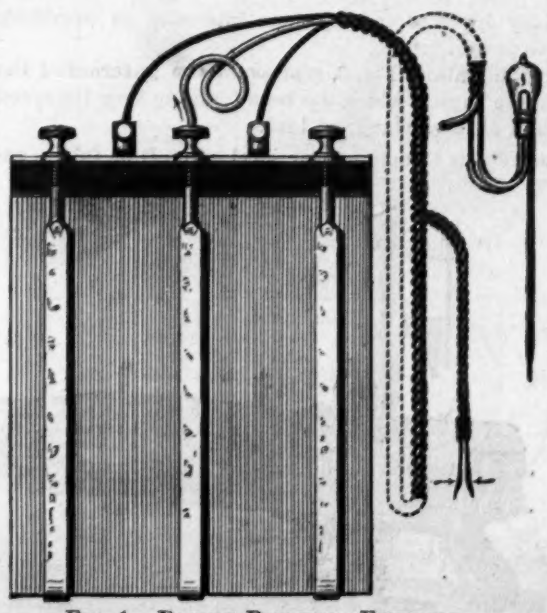


FIG. 1.—POCKET BATTERY—EXTERIOR.

accumulate. Each cell consists of a central rod of zinc between two rods of carbon, and the cells are connected in series, so that an electromotive force of 4 volts is obtained. The zinc cylinders are covered with asbestos cord, tightly wound, which acts to a certain extent as a porous cup, and prevents the action of the liquid upon the zinc when the battery is in open circuit. A rubber band around the bottom of the zinc keeps the elements apart, and their tops are screwed into brasses let into the cover of hard rubber, which is secured to the case by three U-shaped bands and thumb-screws. The trimmings are all finished in nickel plate.

The little lamp attached to a scarf-pin is connected, as shown, to the terminals, and by pressing the two clips together the circuit is closed and the lamp flashes up.

The apparatus, which is manufactured by Messrs. H. Guimaraes & Co., of 37 Ann street, this city, occupies a space 4 inches × 2⅞ inches × ⅞ inch, so that it can be conveniently carried about.

Besides serving as an object of amusement, the battery may be used to good advantage for surgical and dental purposes, its peculiar construction making it well adapted for increased length of service.

Mr. Guimaraes also showed us a battery designed for the use of hospital attendants and which fed a lamp that gave a light of six candles. The cell consists of hard rubber, with a similar cover. To the latter two rods are attached which pass through bearings provided with thumb screws. These rods are about twice the height of the battery resting on the table, and when not clamped slide freely through the bearings in the cover. When the cell is not in use, however, the four rods are clamped to the cover, so that if the battery is set down the long rods lift the cover and the elements attached to it out of the liquid. In this manner waste is prevented and the battery lasts a considerable time without renewal. By unclamping the rods the elements are lowered into the liquid and the cell being provided with a handle, can be easily carried from

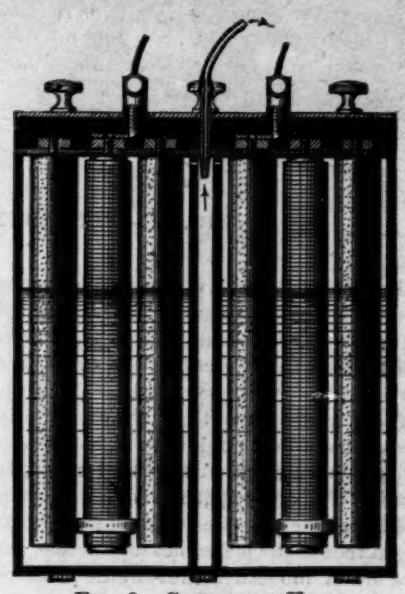


FIG. 2.—SECTIONAL VIEW.

place to place. In addition to the batteries Mr. Guimaraes also showed us a model of a small arc lamp designed by him and fed by the current from the Edison mains. The carbons were $\frac{1}{17}$ inch in diameter and gave a light of about 50 candles when placed in series with a 16-candle Edison incandescent lamp. The lamp is specially adapted to run by battery power, 6 to 8 Bunsen cells being sufficient.

Mr. Guimaraes also has several models of desk lamps from ½ candle-power to 6 candle-power, with batteries, the whole contained in a neat wooden box carried by a handle. Battery will light lamp continuously for from 2 to 12 hours. Mr. G. has also a small dynamo machine, weighing about 30 lbs., which will be in the market in a few days, and which can be operated by foot or hand power, and light ½ dozen 4 candle-power Edison miniature lamps.

The Resistance of the Voltaic Arc.

According to an empirical formula given by Dr. Frolich, the resistance of the voltaic arc is

$$R = \frac{39}{c} + 1.8\,\frac{L}{c},$$

where c = the current in ampères and L = the length of the arc in millimetres. M. F. Lucas gives another empirical formula derived from the use of alternating currents. According to him, the arc behaves as a resistance which is a function of two variables, namely, the strength of the current and the distance between the carbon points or $R = f(I)\,F(d)$. With alternating currents varying from 40 to 75 ampères and carbons 16 mm. in diameter, he found that

$$f(I) = 0.40 \text{ ohm}\left(1 - \frac{I}{80 \text{ amp.}}\right).$$

Hence the general equation became

$$R = 0.40 \text{ ohm}\left(1 - \frac{I}{80 \text{ amp.}}\right) F(d).$$

On keeping the speed of the dynamo constant, the strength of the current varied inversely as the length of the arc, and he found that

$$I = 75 \text{ amp.}\left(1 - \frac{d}{16.67 \text{ mm.}}\right),$$

where d may have any value from 0 mm. to 9 mm. From these results he derived the value

$$P(d) = 1 + \frac{d}{1.4 \text{ mm.}}$$

Hence, by combining these results M. Lucas obtained the formula

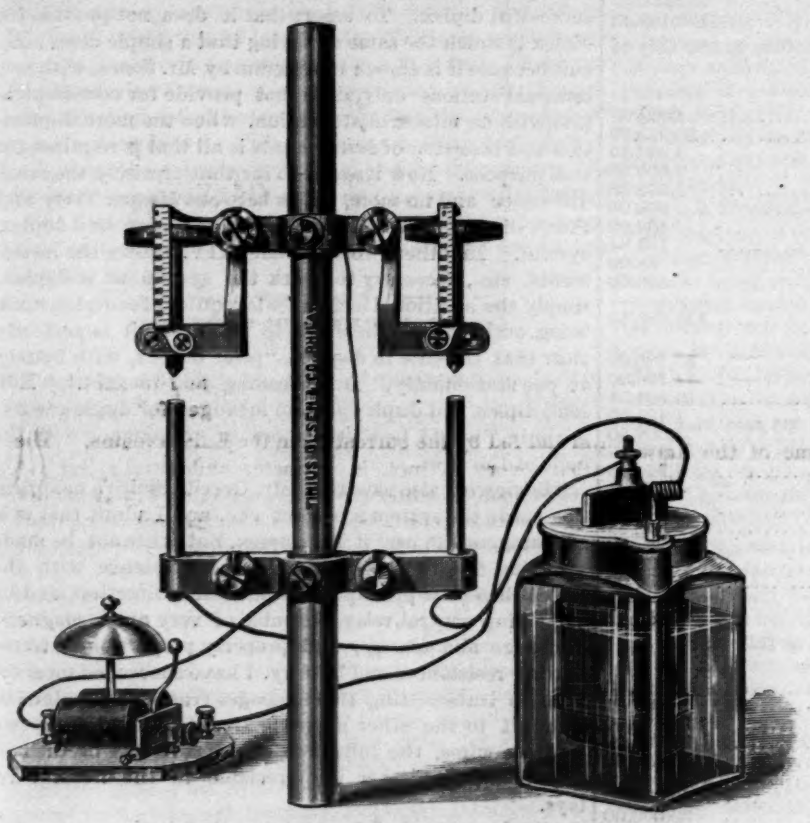
$$R = 0.40 \text{ ohm}\left(1 - \frac{I}{80 \text{ amp.}}\right)\left(1 + \frac{d}{1.4 \text{ mm.}}\right).$$

In the French lighthouse where he conducted his experiments, the normal current is 50 ampères, and the length of arc 44 millime res; therefore the apparent resistance of the arc is by calculation 0.58 ohm. Dr. Frolich's formula gives a somewhat higher value; and it may be that the resistance of the arc is less with alternating than with constant currents.

Electric Measuring Apparatus.

Exact measurement plays such an important part in modern engineering that a ready means of accomplishing results rapidly is essential to the practical application of an apparatus designed for that purpose. The laboratory, with its cathetometers, microscopes, revolving mirrors and standard rules and bars, affords ample means of exact measurement, but for practical purposes the screw still occupies the field where minute variations are to be rapidly noted. The point to be observed in its use, however, consists in bringing the screw to bear upon the object with the same pressure at each successive measurement. Various devices have been used for this purpose, among them the interposition of a spring; but one of the most simple and effective is that which calls in electricity as an aid.

Our illustration shows the manner in which the latter is applied in determining the varying dimensions of a test piece subjected to stress in a testing machine. The central bar, representing the piece to be tested, has two clamps screwed to it, the distance apart of the clamping points being equal to the length which it is required to test. The upper clamp, as shown, carries two micrometer screws with graduated heads and vertical rule, while the lower clamp carries two uprights which rise opposite the micrometers. The upright bars are insulated by bushings of insulating material, so that no current can enter them from the test piece. Their lower ends, however, have wires attached to them which are united and attached to one pole of the battery. The other pole of the battery is connected by wire to an electric bell, and thence to the upper clamp. In the position shown, the circuit is open, but when it is desired to take a measurement the micrometer is brought down to its pin, and the moment contact is made the bell rings. As it requires only the most minute contact to close an electric circuit, the method is evidently a very delicate one, and pressure may be said to be entirely eliminated, thus making each measurement exactly similar in condition.



ELECTRIC MEASURING APPARATUS.

It is evident that this method of measurement may with advantage be applied to other purposes. It combines accuracy with rapidity, and with a little practice the point of contact can be ascertained at the first turn of the screw.

This machine is exhibited at the New Orleans Exposition by Messrs. Tinius Olsen & Co., of Philadelphia, who show there in variety their admirable testing apparatus for use with all kinds of materials.

Battery Tests.

Within the last few years a number of batteries have come into use more or less extensively, the electrical constants of which are comparatively little known among those who frequently have occasion to use them. The electromotive force and resistance of standard sizes of the older forms of batteries, such as the Daniell, Bunsen, and their modifications, are similar, but occasion frequently arises in which new cells are applied of which it is desirable to know the above data. Those who are fortunate enough to possess the necessary instruments can determine these quantities with little delay, but for those who are less fortunate in this respect a few figures will no doubt prove welcome.

At the Philadelphia Electrical Exhibition a number of the more recent batteries were exhibited and the examiners' report upon them has just been published. The number examined included varieties of both open and closed circuit batteries, and the tests were principally confined to the determination of their respective electromotive forces on closed and open circuits, and their resistances.

The method employed in determining the E. M. F. consisted in charging a condenser by each cell and then immediately discharging through a galvanometer. The deflections on the scale being proportional to the potential at which the condenser is charged, it follows that, starting with a cell of known potential, the others are readily determined, being in direct proportion to the deflections obtained. The standard cell used was the Daniell (Wiedemann pattern), and its E. M. F. was assumed at 1.10 volts, the results being calculated accordingly. This value, although somewhat higher than that usually given, does not affect the results to any appreciable extent, whereas, if required, the mere substitution of another value for 1.1 volt will give the desired result, as the ratio of the deflections is known.

The E. M. F. on closed circuit was measured in the same way by momentarily closing the circuit through an external resistance, then immediately discharging the condenser through the galvanometer.

As the external resistance was known this method also gave a ready means of determining the internal resistance of the cell. Since the difference in potential between two points varies directly as the resistance, it follows that the total electromotive force in any part of a circuit is to the total electromotive force in the circuit as the resistance in the part is to the whole resistance. All but the last of these quantities being known or determined, the whole resistance is readily calculated, and subtracting therefrom the external resistance gives the internal resistance of the cell.

NAMES OF CELLS.		Deflection, open circuit.	Deflection, closed circuit.	Volts, open circuit.	Volts, closed circuit.	Internal resist. in ohms.
Standard Daniell		83	....	1.10	.....	.....
Leclanché Disque	No. 1.	130	109	1.72	1.45	1.
" "	No. 2.	134	112	1.77	1.48	1.
Bergman's cells, average of 5		100	88	1.33	1.16	.68
Diamond Carbon	No. 1.	94	85	1.24	1.12	.53
Siemens-Halske	No. 2.	83	36	1.10	0.47	6.5
Partz's large cell	No. 1.	149	135	1.97	1.76	.51
" " "	No. 2.	134	123	1.77	1.62	.44
" Iron "		74	69	0.98	0.91	.3
" Medical "	No. 1.	122	87	1.61	1.15	.8
" " "	No. 2.	120	94	1.60	1.24	.45
Flemming's Leclanché, portable		81	31	1.07	0.42	8.
" " "		111	47	1.47	0.62	13.5
" Cabinet cell	No. 1.	109	52	1.45	0.69	11.
" " "	No. 2.	105	50	1.39	0.66	11.
Leclanché Porous cell	No. 1.	128	80	1.69	1.06	1.3
" " "	No. 2.	122	80	1.61	1.06	1.3
" "Prism" zinc in porous cup	No. 1.	115	79	1.53	1.05	.98
" "Prism" zinc in porous cup	No. 2.	117	79	1.55	1.05	.95
" "Prism" free zinc	No. 1.	118	83	1.55	1.10	.83
" Diamond Carbon	No. 2.	94	78	1.24	1.00	.44
Fitch's Chlorine cell	No. 1.	98	73	1.30	0.97	1.7
" " "	No. 2.	95	61	1.25	0.80	2.8

The accompanying table shows the values determined in this way, and the inference to be drawn from these figures we leave to our readers. It will be noted that the electromotive force on closed and open circuits of some of the batteries shows considerable variation, a point which, as a rule, is not treated with sufficient consideration in the arrangement of batteries.

The last column gives the internal resistance of the various cells, but it loses some of its value from the fact that the description of the cells gives no clue as regards their dimensions. A little more detailed information on this point would have put to rest any doubts that might arise regarding the size of the cells tested.

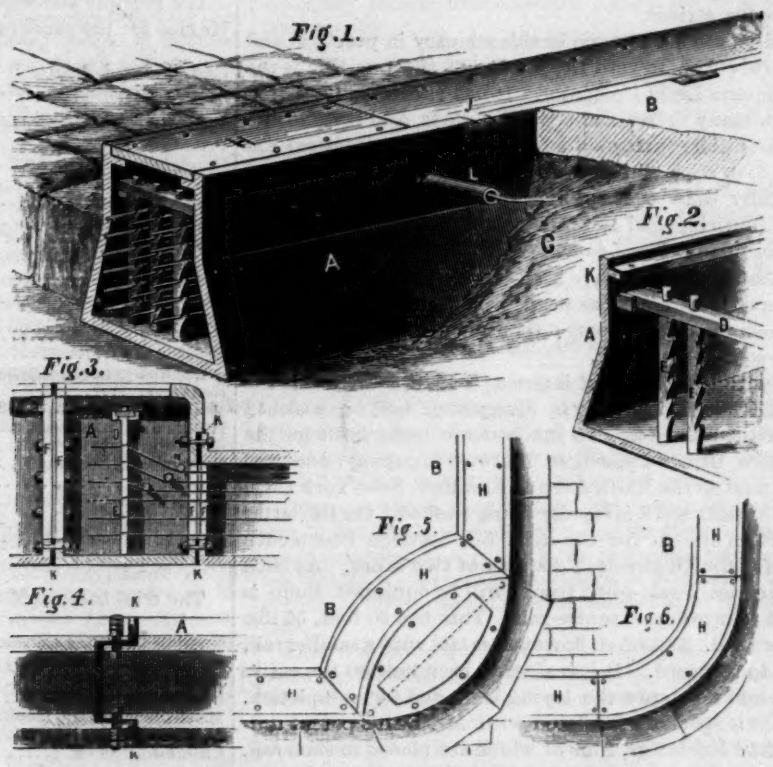
The current strength of the cells was also measured at intervals in minutes, the external resistance being generally 2.17 ohms. The current strengths determined in this way cannot be taken as the real capabilities of the cells, since it is evident that, with the same external resistance, a high resistance cell would show an inferior result when compared with a cell of low resistance, other things being equal. The results, however, within limits, give a fair idea of the constancy of some of the batteries; but it is to be regretted that time lacked to extend the tests so as to determine the life or action under more prolonged service, the actual tests not exceeding one hour for any single cell.

Woodward's Curb Conduit.—System B.*

("*A. b.*" *of the Section's Classification.*)

Company's Description—Edited by the Examiners.

In the accompanying engraving, Fig. 1 is a perspective view of the combined curbstone and conduit, showing the wires in position; in the second figure the wires and cover are removed; Fig. 3 is a vertical section taken at a street corner; and Figs. 5 and 6 are plan views at street corners, the former being an inlet corner and the latter the usual rounded corner; Fig. 4 is a horizontal section illustrating the method of securing together the conduit sections in order to permit expansion and contraction. The hollow curb conduit sections *A*, made of cast iron or other suitable material, are formed with vertical sides above the street pavement to form the curb, and those portions sunk in the ground are widened out at the bottom to guard against displacement and provide ample space. The cover *J* is about flush with the sidewalk. Between the cover and the top of the ledges is placed a water-tight packing. The wires are supported by a series of vertical racks *E*, fixed at suitable intervals apart. The lower ends of the racks enter sockets in the bottom of the conduit, while their upper ends pass through holes in the cross-stays *D*, the extremities of which rest in brackets on the sides. The ends of the conduit section are flanged and bolted together, packing being inserted between them.



THE CURB CONDUIT SYSTEM.

When it is necessary to provide for longitudinal expansion and contraction of the several sections, they are made with overlapping ends, and are secured by bolts passing through slots in one of the flanges. Packing is placed between the joints. The wires are inserted from the open top of the conduit and rest in the teeth of the racks. After they are in position the cover is bolted down. When it is desired to conduct one or more wires into a building, small lateral pipes *L* are connected to the side of the conduit. With this construction the wires are always easily accessible, and the tearing up of the pavement in order to reach particular points is obviated. The two-plan views show clearly the methods of rounding corners. When the conduit crosses the street where the curb ends, those wires which are above the line of the depressed part are directed downward (Fig. 3), and kept in place by means of transverse studs *N*.

The advantages claimed for this system are: That it is easier and cheaper to place the wires in the curb than to tear up the streets and put them in an underground conduit. That owing to the curb conduit widening and deepening

* Report of Board of Examiners, Section 18, Underground Conduits, International Exhibition, Philadelphia.

from the level of the paved street, it gives ample room for holding any number of wires.

That to introduce into a house any telegraph, telephone or electric light wires, by merely removing a few bricks from the pavement, the connection is made direct with the curb conduit instead of excavating many feet of earth in the pavement and the street by the underground conduit.

That it is always accessible.

If anything happens to a wire, or a new one is to be introduced, one can always get to it in the curb conduit, and during the snow and ice of winter, when the authorities of cities will not allow the streets to be opened, the curb conduit is as accessible as in the warm months of summer.

In this system no provision is made for keeping the conduit free from moisture, so that a first-class insulation is required for the wires or cables used. Further, no method is proposed for obviating the efforts of induction in telephone circuits.

To obtain the advantages claimed for it, a conduit must be run on both sides of the street in order to give house-to-house supply.

It would further appear that a long line of iron plate along the sidewalk would be dangerous to foot passengers in frosty weather and would interfere with present arrangement of gas lamps and the existing sub-pavement and street cellars.

No estimate of cost was given. The system would necessarily be an expensive one.

The Coming Tests of the Daft Motors.

Within a very short time a most interesting and important trial and test will take place. Electrical transmission of power is rapidly coming to the front with tremendous strides.

Standing second to none in this country in practical and successful efforts toward the solving of this question is the Daft Electric Light Company. It has successfully passed through many severe and critical periods, and it stands to-day better able, through its years of stern practical experience, to cope with the question both financially and electrically than ever before. Such is the perseverance, energy, untiring zeal and indomitable will of the founder of the company, Mr. Leo Daft.

Thousands of miles have been traveled by these motors, and heavy machinery has been driven in daily hard life for fifteen months or more, thousands of feet from the primal source of energy.

It is with the deepest of interest, then, that we await the coming trials of its motors. Every step will be watched with critical interest. Two motors are being built for the Baltimore Union Passenger Railway Company, and one for the trial on the Ninth Avenue Elevated, New York City. On both roads work is rapidly being pushed. On the latter the portion chosen for the trial lies between Fourteenth and Fifty-fourth streets, a distance of two miles. As both up-town and down-town tracks will be equipped, there is needed four miles of centre rail. This is a 30 foot, 56 lbs. standard rail. A portion, however, is laid with a smaller rail, 50 lbs. to the yard. It has already been hoisted the entire length and now only the laying is needed for completion. This rail is specially insulated with Mr. Daft's patent umbrella-like insulators, four of which are placed to each rail. Already the laying is finished from Fourteenth to Thirty-fourth street, on the up-town track. The trackmen finding it a little novel at first, slow progress was made. Now nothing could be easier. Its completion will be noted within about 10 days or a fortnight. It is proposed to use the two centre rails parallel for the outgoing current and the four outer or regular rails for the return current. By this means the resistance will be reduced to almost nothing, the calculated resistance of such a system being very slight indeed. The framework of the motor is completed and now only the work of assembling is needed to finish it. Its estimated weight is about seven tons. Mr. Daft, an Englishman by birth, has won the hearty thanks and good fellowship of all Americans in giving to this electric motor, the largest ever constructed in the world, the name of our illustrious countryman, Benjamin Franklin.

On Sixteenth street, in an old sugar-house—No. 428—the stationary engine, one of Mr. Wright's 150 horse-power engines, and the dynamos, will be placed. The foundations are nearly completed, and work is rapidly being pushed. Within a few weeks the primary station will be in readiness. In remembrance of much talk these energetic movements are hailed with satisfaction. Such matters cannot be hurried, but, now the initial step is taken, we know the end must come. It does not pay to undertake and work out new projects in a hurry. Haste makes waste. What we want is steady, reliable progress, denoted in practical units of horse-power, not in small quantities of ergs.

G. W. M.

Mexican Telephone Interests.

The Mexican Telephone Company held its annual meeting in New York on the 8th inst., electing the following directors, of whom the last three succeed Messrs. Bryant, Hawley and Hayes: F. B. Beaumont, William Reed, J. H. Goodspeed, E. B. Welch, George W. French, J. D. Sargent and A. E. Denison, all of Boston. The report of the officers for the year ended March 1, 1885, to be sent to the stockholders when printed, showed the year to have been, all things considered, a fairly prosperous one. There was a good increase in rentals and a heavy reduction in expenses, compared with 1883–84, but the cost of reconstruction and of extensions made a heavy drain upon the profits. The exchange in the City of Mexico was rebuilt; hundreds of new poles were set; a new line was built to Guadalupe and an exchange of 23 subscribers opened there. The company made a new contract with the American Bell Company for instruments during the year, besides obtaining valuable concessions in Mexico. The report will show 3,136 instruments owned by the company, of which the parent company has 945. The number in use March 1, 1885, was 833, an increase of 269 during the year. There was a decrease in the expense account in the city of Mexico from $51,944.01 in 1883–84 to $29,909.17 in 1884–85, or $22,034.84, and an increase in rentals from $20,947.94 in 1883–84 to $29,451.56 in 1884–85, or $8,503.62. The receipts and expenditures at the Boston office for the year ended March 1, 1885, were :

RECEIPTS.	
Cash on hand	$149.59
Loans	1,770.14
Supplies sold	542.40
Interest received	4.11
Remittances from general manager	4,398.29
Royalties on instruments	5,323.90
Notes payable	4,000.00
Total	$16,188.43
DISBURSEMENTS.	
Salaries	$2,750.00
Expense account	719.42
Supplies	2,042.70
Interest	165.69
General manager's drafts paid	9,500.00
Old accounts settled	92.37
Balance on hand, March 1, 1885	918.25
Total	$16,188.43

The receipts and expenditures of the office in the City of Mexico for the same period were :

RECEIPTS.	
Cash on hand, March 1, 1884	$639.95
Telephone rentals	29,073.73
Supplies	3,252.40
William Reed, Treasurer	9,500.00
Premiums on exchange	1,372.58
Gaudalajara Company	230.00
Interstate Company	462.02
Vera Cruz Company	159.84
Peninsula Company	58.00
George L. Wiley	536.60
Total	$45,285.12
EXPENDITURES.	
Supplies	$3,185.29
Operating expenses	14,196.20
Construction	10,703.51
Office and general expenses	1,421.66
Rent	1,008.00
Traveling expenses	872.35
Rights and franchises	4,945.00
Remittances to Boston	4,398.29
Premium on exchange	830.06
Freight	1,948.34
Gaudalajara Company	917.88
George L. Wiley	323.50
Balance on hand, March 1, 1885	535.04
Total	$45,285.12

The trial balance March 1, 1885, was as follows:

DEBITS.	
Guadalajara construction account	$25,242.43
Interest account	488.04
Rights, franchises, etc	823,470.00
Puebla Company stock	30,000.00
Mexican Peninsula stock	65,490.00
Mexican Central stock	59,040.00
Chihuahua stock	20,000.00
Durango stock	36,000.00
Mexican Northern stock	37,000.00
M. L. Guirsud	15,549.25
Utica F. A. Telephone Company	121.00
Cash	918.25
Mexican Interstate Company	601.50
Construction account	117,535.96
Vera Cruz Telephone Company	1,015.05
Salary, rent and account	13,094.38
Mexican Northern Telephone Company	1,402.83
Mexican Pacific	3,540.00
Puebla	1,255.00
Mexican Peninsula Company	625.00
Chihuahua Company	375.00
Mexican Interstate stock	40,000.00
Total	$1,313,863.86
CREDITS.	
Capital stock	$1,280,000.00
Notes payable	2,000.00
Accounts payable	9,928.83
Rental	21,935.03
Total	$1,313,863.86
ASSETS.	
Supplies on hand	$14,323.01
Instruments	17,947.60
Cash on hand	1,596.95
Rentals due from licensees	8,935.38
Total	$42,702.94
LIABILITIES.	
Notes payable	$2,000.00
Accounts payable	9,928.83
Surplus invested in property	30,774.11
Total	$42,702.94

Ten Questions.

To the Editor of The Electrical World :

Sir : Please answer the following questions. By doing so you will confer a great favor :

(1) About what temperature Fahrenheit does the glass tubing, such as can be bent in an alcohol lamp, commence to soften? (2) Is this kind of glass affected by melted sodic acetate? (3) At what temperature does sodic acetate melt? (4) When used in warming horse-cars, are the *solid crystals* simply melted and then allowed to crystallize again, and thereby give out the heat previously absorbed? (5) Or is there some liquid put in with the crystals before heat is applied? (6) Does melted sodic acetate act on iron, copper, brass, or zinc, or nickel? (7) What is meant by *super*heated steam? (8) Is it simply steam under pressure say 30 pounds to square inch? (9) What is price per pound of German silver in strips? (10) At what temperature Fahrenheit does the current from a thermo-electric couple composed of iron and German silver commence to weaken before reversing its (the current's) direction? J.

Cold Spring Harbor, N. Y.

Answers.—(1) At about 1,000°. (2) It is not below the melting point of glass. (3) Below 500°. (4) Yes. (5) No. (6) No. (8) It is steam at a temperature above the boiling point. (9) See advertisements and send for trade price-lists. (10) Not known.

Diplex and Duplex.

To the Editor of The Electrical World :

Sir : In my communication to your esteemed journal of the 21st ult., I stated that the telegraphic system discussed in your column by Messrs. Terry and Finn on the one hand and by "Reviewer" on the other was "in my opinion a combined diplex and duplex system." In making this assertion I supposed that the controversy included the *system* of which the *arrangement* shown in Plate XIV. is only a part. I now comprehend that it is merely the proper title of the subject-matter of Plate XIV. and page 37 of "Illustrations and Descriptions of Telegraphic Apparatus," which has been under discussion, and I readily admit that no diplex arrangement of instruments appears therein; but I cannot agree with "Reviewer" "that the *system* does not provide for diplex communications," as it was invented by Edison chiefly with that end in view, and indeed it was the first successful diplex. To assert that it does not provide for diplex is much the same as saying that a simple closed circuit because it is shown in diagram by Mr. Jones, with two terminal stations only, does not provide for communication with an intermediate station, when the mere duplication and insertion of instruments is all that is required for that purpose. Now it seems to me that precisely the same difference and no more, exists between Messrs. Terry and Finn's diagram and Edison's combined diplex and duplex system. In other words, Plate XIV. shows the instruments, etc., necessary to work the system as a duplex, simply the additional instruments required for diplex work being omitted, and therefore to my mind it is perfectly clear that the title in dispute, "polar duplex, with battery at one station only," is misleading and inexact. "Edison's diplex and duplex system arranged for duplex working only," would be a title more in consonance with the facts of the case.

"Reviewer" also says that Mr. Gerritt Smith's modification made the system a perfect one, and I admit that it is advantageous to use it for duplex, but it cannot be made available for diplex working. My experience with the system has been principally in the latter direction, and by employing neutral relays, capable of very quick magnetic discharge and charge, and properly proportioned transmitting resistances and battery, I have succeeded on short lines in transmitting two messages from one terminus of a circuit to the other as perfectly as if I had used two separate wires, the influence of the reversals of the battery being altogether inappreciable in the neutral relays.

All telegraph electricians know that in the quadruplex the effects of the reversals of the battery are very perceptible, and the gain in this respect in favor of the diplex may be easily explained by the increased retardation of the magnetic movement of the cores of the quadruplex relay by the inductive action between its two differentially wound helices.

John C. Wilson.

Boston, Mass.

WESTERN NOTES.

The Electrical World Branch Office,
Chicago, April 16, 1885.

The Amet electric governor for engines, which was illustrated some weeks ago in The Electrical World, is fulfilling all the promises that have been made for it, and the Globe Electric Engineering Works are putting in machinery for its manufacture on quite a large scale. It has been submitted to competent experts and all kinds of tests, and has received the highest indorsements. Quite a number of the governors are already in practical use and giving satisfaction. At a recent test twenty-three out of twenty-nine lights were thrown off, and the speed was automatically and promptly reduced from 315 to 107 revolutions. It is one of those simple inventions which often prove so valuable.

Messrs. W. B. Cleveland and Wm. H. Harvey, of the Forest City Electric Works, paid this office a visit on the 7th. The company are about ready to put upon the market incandescent electric lighting machines of their own manufacture. They will not go into the manufacture of lamps at present, but will use some one of the standard forms of incandescent lamps in connection with their own machines. Their factory is located at Cleveland, O., as the name of their company implies.

I learn that the Molecular Telephone Company are operating an exchange in Cleveland, Ohio, of 175 subscribers, and that they are just adding 60 or 70 new telephones, making nearly 250 in all.

The Chicago Electric Light Association held a meeting

on the evening of the 4th inst., at which some routine business was transacted. The next meeting will be held May 14th.

From the message of President Diaz, of Mexico, it is learned that the telegraph lines of that federation have been increased 401 miles since last September, and that there are now 13,224 miles in the republic.

The Western Electric Company have an order for eight miles more cable for Boston.

Among the late electric bell and annunciator jobs taken by the Railway Telegraph Supply Company are the general offices of the Wisconsin Telephone Company, and the offices of Assistant General Manager Miller, and General Superintendent Clark, of the Chicago, Milwaukee & St. Paul Railway Co.

The Jefferson Bain Electric Light and Power Company has been incorporated, with a capital stock of $25,000. The incorporators are M. B. Bailey, S. C. Higby, W. E. Callin, A. S. Huter and William W. Weaver.

The Insane Asylum at Provo, Utah, is to be lighted by 75 Brush incandescent lamps.

The Baltimore & Ohio Telegraph Company are connecting their Chicago office with the new Board of Trade, and now have the greater portion of La Salle street, between Madison street and the Board of Trade building, torn up for that purpose. They are laying three pipes underground and will draw 19 galvanized, No. 8, wires into each pipe, making 57 wires in all. This work is being done independent of the conduit company.

Mr. F. R. Welles, Manager of the Western Electric Company's Antwerp (Belgium) branch (the Bell Telephone Manufacturing Company), sailed for America on the 11th inst., and is expected to arrive in this country the last of this week or the first of next. Mr. Welles expects to remain in America a few weeks only. The Bell Telephone Manufacturing Company, by the way, turn out much more handsomely finished instruments than do the generality of manufacturers here. They go in more for a high polish and glistening exterior over there, and manufacturers for the European trade find it necessary to cater to this taste.

The Illinois Central Railroad Company are at present engaged in testing the practicability of electric headlights for their engines.

THE TELEGRAPH.

Fears for a Telegraph Ship.—A telegram from London, on the 15th inst., says that it is feared that the steamer Magneta, belonging to the Eastern Extension Telegraph Company, has been lost in the Bay of Biscay. She had a large staff of telegraph officials on board.

To Warn of Earthquakes.—The Seismological Society of Japan has suggested the use of telegraph stations to give warning of the approach of earthquakes. A shock at any one station could be made to complete an electric circuit and fire a gun at Tokio or Yokohama, thus giving from two to six minutes' notice to the inhabitants.

Western Union Sued for Negligence.—The suit of the White Quail Mining and Smelting Company, of Colorado, against the Western Union Telegraph Company to recover damages for losses said to have been caused by the alleged negligent handling of a telegram sent in October, 1883, was called for trial before Judge Butler, in the United States Circuit Court, Philadelphia, on April 10. Most of the evidence was taken by depositions. The counsel for the telegraph company, including ex-Attorney General Brewster, objected to this form of testimony, demanding the production of the legal proceedings in the West. The objection was sustained and the case withdrawn from the jury.

Pittsburgh Poles.—The fight over the use of certain poles in Pittsburgh, Pa., was described last week. The sequel is given in the following dispatch of April 8: Judge Stowe this morning delivered an opinion in the injunction suit brought by the city and Western Pennsylvania Telephone and Telegraph Company against the Western Union Telegraph Company, in which he sustains the position assumed by the former, and grants a permanent injunction against any further interference on the part of the Western Union. The evidence submitted showed conclusively that the city has owned and maintained the line of poles in dispute since 1866, and that while the Western Union rebuilt the line in 1876, the title remained in the city.

To Pay That Tax on Stock.—Justice Peckham, in Chambers at Albany, on April 10, granted an order making the decision of the Court of Appeals the judgment of the Supreme Court in the case of The People against the Western Union Telegraph Co. The action was to recover $131,818.66 tax, at the rate of one-quarter mill for each one per cent. of dividends declared on the capital stock. The Hon. Samuel Hand, to whom the case was referred, reported judgment in favor of the plaintiff for the amount claimed, with interest, making in all $178,397.26. The company appealed, but the judgment was affirmed by both the General Term and the Court of Appeals. Justice Peckham also granted an order in the case of The People against the Gold & Stock Telegraph Company, in which judgment of $7,500 for plaintiff for unpaid State tax was affirmed by the General Term and Court of Appeals.

Tied-up Tickers.—As we stated in our last, the Gold & Stock Telegraph Company has obtained an injunction against the Commercial Telegram Company, forbidding the use of the latter's tickers. The Commercial "ticker," like the Gold & Stock instrument, has two sets of clockworks which run two printing wheels, one containing letters and the other figures. The wheel which prints the figures is the one which was shown to be an infringement on the Gold & Stock, and this is the wheel which has been locked on all the Commercial instruments to satisfy the order of the court. Since then the instrument has been run with only the letter wheel, the prices being given by a sort of phonetic system. Of course the brokers don't relish this much, but it is claimed that the greater speed of the Commercial ticker enables it, though "one-legged," to keep up with its rival. As the Callahan patent under which the injunction has been obtained expires on the 21st, it is understood that the Commercial tickers will be run as usual after that day. The Gold & Stock Company will press suit for damages for infringement during the last two years.

THE TELEPHONE.

Bell Stock Subscription.—The right to subscribe to the $200,000 Bell telephone stock expires May 9, subscriptions to be paid and stock delivered May 14.

The Van Rysselberghe System.—The French government, satisfied with the experiments made on the lines between Rouen and Havre, has given the Messrs. Mourlon & Co. the operation of the line between Paris and Rouen on the system devised by M. Rysselberghe.

Limiting Subscription Rates.—The Indiana Senate has passed a bill limiting the price for rental of telephones to $3 per month, with a further reduction of 50 cents where two or more instruments are used by the same firm. The bill had previously passed the House, and now awaits the Governor's signature.

Balm for the Telephone Subscriber.—The Supreme Court of Ohio has decided that a subscriber cannot swear over a telephone line without the consent of the company. But the subscriber can derive consolation from the fact that he is still permitted to swear at the company without the consent of the telephone line.—*Norristown Herald.*

Asking Equal Rights.—In the Superior Court of Maryland, on April 11, a suit was instituted by the Baltimore & Ohio Telegraph Company against the Chesapeake & Potomac Telephone Company for a mandamus to compel the defendant to furnish to plaintiff the same telephone facilities that it furnishes to the Western Union Telegraph Company or to any other similar company in this State.

Suburban.—The Suburban Telephone Company has declared a dividend of 2½ per cent. This is the dividend announced in January as likely to be paid in April. The money is derived from payment of a loan by the Erie Company. Boston & Northern Telephone stockholders will receive a like benefit in due season. The Suburban dividend is payable April 20, amounts to something over $11,000, and will be distributed among some 400 shareholders.

Quick Profits.—"These Texans," says a correspondent, "do what they do in a grand style. They are well up with all the advances of modern times. I find the telephone everywhere and it is used much more than the telegraph—one can go to the telephone in his hotel in any one of the towns and converse with any other town 100 miles away. There are ten times as many telephones in Texas as in Georgia. A friend of mine while in Gainesville talked to his family in Sherman and then to his agents in Waco and Dallas. He is in the lumber business, and when a man in Denison inquired by telephone what he would sell him two carloads of shingles for, he immediately telephoned a shingle man in Texarkana and got his reply, and then answered the Denison man. He said he made $54 by the transaction. The telephone is hurting the telegraph badly."

Investigating in Ohio.—The committee of three of the Ohio Legislature, appointed by Speaker Marsh to investigate the telephone companies doing business in Ohio, have prepared a report in which they say: "There are about 12,000 complete sets of instruments in use in the State, all owned and controlled by the American Bell Telephone Company of Boston. These instruments are leased to the local companies at an annual rental of $20 for each set, making the annual tribute paid by these local companies over $200,000. The cost of each set of instruments did not exceed $3.35. On instruments which did not cost the Bell Company over $40,000 the company receives over $200,000 annually. The Bell Company, before granting a franchise to a local company, exacts from 30 to 35 per cent. of all stock of the local company using its instruments, and from 20 to 25 per cent. of the gross earnings of all toll on extra-territorial lines. The committee states that in its judgment the Bell Company is an imperious and unconscionable monopoly, and should be restricted by legislation, or at least be taxed upon the commercial value of its instruments; also, that the Bell Company should be required to pay, in addition to the taxes upon its instruments, a tax upon gross receipts.

THE ELECTRIC LIGHT.

Elizabeth, N. J.—The Eastern Electric Light Co., organized recently at Elizabeth, N. J., for work with the Van Depoele system in the East, will light that city at once. The company propose to erect a tower at the railway depot, to be 150 feet high and carry six arc lamps placed under a huge reflector. These lamps will be stationary at the top of the tower, and a man will go up in a wire basket to arrange or repair the lights.

More Ducks.—Mr. F. M. Hannah, assistant purser of the steamship "Roanoke," reports that on Sunday night, as the ship was coming down James River with her electric light in full blaze, she ran into a flock of canvas-back ducks off City Point, and played sad havoc with the dainty birds. Country ducks, it must be remembered, are not familiar with Edison's invention, and were completely "paralyzed" by its brilliancy. They flew into the rigging and against the house, and some 100 of them fell dead on the deck of the ship, to say nothing of a large number which tumbled into the water.—*Norfolk Virginian.*

Brooklyn, N. Y.—The Aldermen have granted the Citizens' Electric Illuminating Company the right to light certain thoroughfares of the Western District, the lamps to be each of 1,200 candle-power. If the aldermanic resolutions become operative, 152 electric lights of 1,200 candle-power, 200 feet apart, would be required on Fulton street, from the ferry to Bedford avenue; Myrtle avenue, from Fulton to Bedford avenue; Atlantic avenue, from the ferry to Fifth avenue, and Court street, from Joralemon to Atlantic avenue. The cost of the lights would be $27,740, or $182.50 each per annum. Should the lights be of 2,000 candle-power, 270 feet apart, 108 lamps would be required, costing $27,594, or $255.50 each. The number of gas lamps displaced would be 852, which cost yearly for lighting $17,488.40.

New York Streets.—Bids for lighting the streets of the city for the coming year were opened last week by the Gas Commission. They were as follows, the price given being for each lamp: Consolidated Gas Light Company, all lamps south of the Harlem River, $17.50; Mutual Gas Light Company, for all lamps on its mains, $17.50; Equitable Gas Light Company, for all lamps on its mains, $12; Central Gas Light Company, for all lamps in the Twenty-third Ward, $28; Northern Gas Light Company, for all lamps in that part of the Twenty-fourth Ward formerly West Farms, $30; Yonkers Gas Light Company, for all lamps in Kingsbridge, $30; New York & New Jersey Globe Gas Light Company, for lamps at Woodlawn Heights, $25; Brush Electric Light Company, for lights on various streets, $255.50 per lamp; United States Illuminating Company (electric lights), $255.50 per lamp; Harlem Gas Light Company, $17.50. Last year the Equitable Company bid $17.50, and did not furnish the lamps. This year it includes the lamps in its bid. The Harlem last year bid $19.50, the Central $29, and the Northern $32.

Germantown, Pa.—Notwithstanding the obstacles with which the Germantown Electric Light Company has had to contend since the plant was located here in January, says the local *Independent* of April 11, it is now held in better favor by our business people than ever before and is rapidly gaining public favor. Many of our business men consider electricity indispensable for illuminating purposes, and attest their appreciation by the introduction of additional lights. For a time the light was held in bad repute on account of the unsatisfactory results given. But since the appointment of F. A. La Roche, a thorough electrician, as superintendent, all complaint has been hushed, and the lights are now giving the very best results possible. It is proposed in a short time to increase the plant to a capacity of 100 lights. A circuit will be placed on East Chelten avenue and other streets, subscribers having already been secured to warrant the extension. The superintendent has demonstrated that it is possible to run incandescent and arc lights from the same circuit, having three of the former lights running nightly in the company's office. In addition to using the power for electric lighting at night, it is proposed to rent electric power during the day for running sewing machines, elevators, motors for dentists, fans for stores, etc., ranging from one-tenth horse-power to a five horse-power motor.

APPLICATIONS OF POWER.

An Electric Railway for Philadelphia.—At a meeting of the Committee on Plans and Improvements of the Fairmount Park Commission, of Philadelphia, on the 14th inst., Superintendent Thayer presented a report recommending the construction of the Bidwell Electric Railway along Belmont avenue, from the Park boundary to Highland avenue on the north. The report was adopted, and it was agreed to report the matter favorably to the board. The fare is to be 5 cents.

MISCELLANEOUS NOTES.

Horror!—A London paper gravely announces that St. Petersburg is anxiously awaiting the arrival of an American pianist who promises, by the aid of electricity, to play twelve pianos simultaneously. Russia's cup of misery will soon overflow. It beats Morphy with his twelve simultaneous games at chess.

Effect of Moon and Tides.—The *Cosmos les Mondes* states that M. Leblond has detected by the employment of lines analogous to telegraph lines, but with the extremities plunging into the sea, that there are periodical variations of intensity in terrestrial currents in direct relation with the movement of the moon or the tides.

The Washington Monument Struck.—While a heavy storm was passing over Washington, D. C., on April 8, the Washington Monument was struck three times by lightning without causing the least damage. Colonel Casey examined the aluminium tip next morning with a powerful telescope, and found it as sharp and bright as when it was placed on the summit some months since.

As in a Glass Darkly.—A French inventor has perfected an apparatus which enables railway dispatchers—men who control by telegraph the movement of trains on several divisions of the road—to see in a mirror the entire section under their charge. The apparatus consists of a sheet of opaque glass, on which the rails are indicated by horizontal lines and the stations by vertical ones, numbered. Little arrows, representing the trains, move along the horizontal lines. They are put in motion by aid of electricity, developed by the contact of metallic brushes attached to the locomotives with zinc heads placed along the rails. The train thus continually traces its trajectory on the glass indicator. The apparatus was exhibited a few weeks ago in Germany to a commission of Berlin scientists. While ingenious, it is said to be of not so much practical value as would at first appear. By the system now in use, dispatchers, knowing their divisions thoroughly, as they invariably do, can see the trains mentally as well as though they were shown in a mirror before them.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 54, a 54⅛; Am. Dist. Tel., b 12, a 25; B. & M., b 2, a 3; Mutual Union, b 31; Postal stock, b 1¼, a 1⅜; Western Union, b 59⅛, a 59¼.

Telephone.—Am. Bell, b 204, a 205; Erie, b 20, a 20⅛; New England, b 26, a 27; Mexican, b 1¼, a 1⅜; Tropical, b 1¼.

The Boston *Herald* says: Bell telephone further receded to 205, with sales still moderate. The rights followed the stock down with sales at 2.10. The stock appears about low enough to be whirled up on some item of favorable news—legislative, for example.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Anti-Magnetic Shields for Watches.—These shields, made by Giles Brothers & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches which are already affected.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED MARCH 31, 1885.

Electric Arc Lamp; Philip Diehl, Elizabeth, N. J.. 314,567

The clutch consists of an arm suspended from the supporting arm of the cores, to which it is pivoted at its upper extremity, while its lower extremity is pivoted to a portion of the movable frame surrounding the carbon-holder. A lug upon the clutch-arm is designed to press against the holder upon one side, while the opposite side is grasped by the movable frame. The movement of the cores under the superior influence of the coil of thick wire causes the clutch to grasp the holder, and the subsequent movement of the frame secures the required separation of the carbons. When the arc becomes of too great resistance, the movement of the cores in the opposite direction at first lowers the carbon, and ultimately causes the holder to be released, and the carbon is permitted to drop by its own weight a sufficient distance to maintain the required arc.

Conduit for Electric Wires; Josiah S. Du Bois, Camden, N. J..... 314,568

Consists of an underground conduit provided with cylindrical pockets or troughs for supporting the electric wires, made of light sheet metal, cylindrical or polygonal in cross-section, and having a narrow longitudinal slot in its upper part, the said pockets being arranged side by side in rows in the same horizontal plane, and the rows being arranged one above the other.

Safety Catch; Edward H. Johnson, New York, N. Y., Assignor to the Edison Electric Light Co., of same place..... 314,582

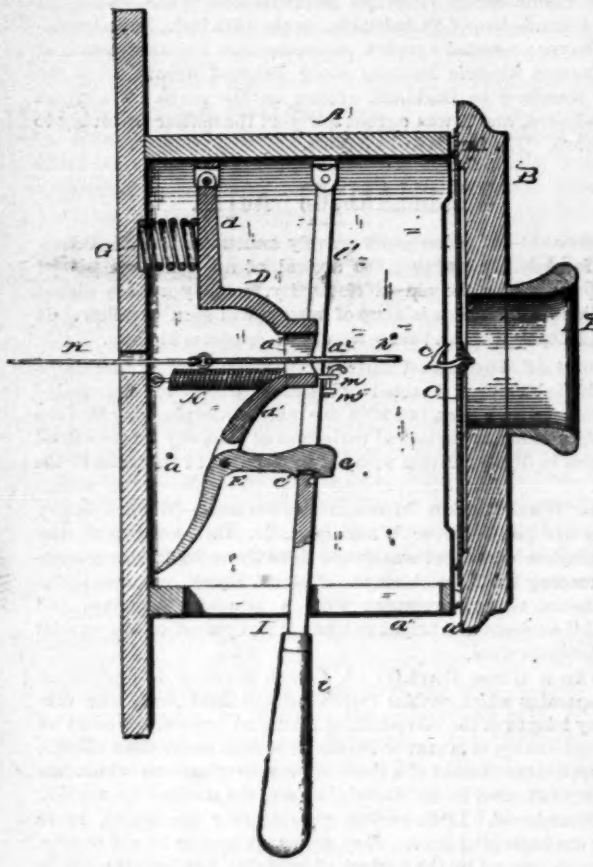
Consists of the combination, with the conductors of a circuit, of a safety-catch located in each pole or side of the circuit.

Copper-covered Wire; James Spruce, Waterbury, Conn., Assignor to the Scoville Manufacturing Co., of same place..... 314,618

Consists in a steel or like wire core inclosed by a strip of copper in width to extend two or more times around the core, the outer edge substantially meeting the line of the inner edge, and so as to lie in the depression in the covering beneath it formed over the inner edge.

Secondary Electric Clock; William F. Weisgerber, New York, N. Y..... 314,634

When the electro-magnet is vitalized, the secondary section being somewhat closer to the core, is attracted first, and by its action upon the main section the latter is moved toward the core,



MECHANICAL TELEPHONE. 314,946.

so that it is finally attracted by the action of a comparatively weak current of electricity, the lever which carries the propelling pawl being moved a short distance by the action of a secondary section of the armature upon the main section, so that it requires comparatively little power to complete its motion.

Conduit for Electrical Wires; Mathew H. Devey, Chester, Pa..... 314,655

Consists of the combination, with the conduit-section, of the heating pipe, escape pipe, and pure air supply pipe, and suitable supports for the wires.

Electro-Magnetic Car Brake; Harvey S. Park, Henderson, Ky..... 314,709

Consists of a train of concave and convex V friction wheels or rolls, arranged between a windlass and the truck-axle, and fixed hangers or supports having circular bearings for said windlass, and slotted bearings for the intermediate friction-roller.

Electric Battery; Isaiah L. Roberts, Brooklyn, N. Y. 314,722

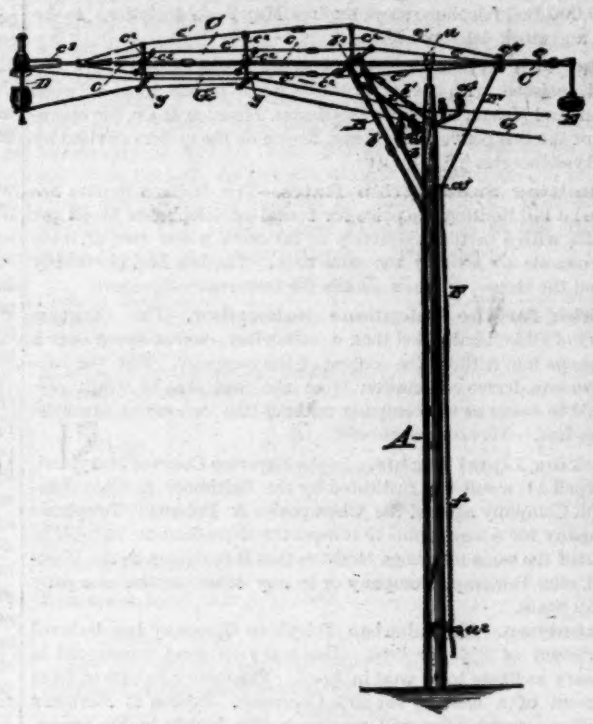
It is to feed liquid gradually into the carbon, from a reservoir or holder made of impervious material, and arranged above the level of liquid located outside the carbon in the cell, and to prevent its escape from the carbon except through the pores of the carbon.

Electric Railway Signal; William T. Waters, Atlanta, Ga..... 314,760, 314,761, 314,762 and 314,763

First. Consists in electric railway signals constructed with a series of insulated contact-bars projecting from the train to engage with pairs of insulated contact-arms projecting from posts at the side of the track, provided with wire conductors extending forward and rearward, and connected with electro-magnets secured to other posts, and having pivoted armatures provided with hooked ends and springs to engage with signals pivoted to the said posts, so that, the circuit being closed by the passing train, a current of electricity may be sent to the said electro-magnets, which will withdraw their armatures.

Second. Consists in the combination of switches and other appliances with the operating mechanisms of the signals, to make the said signals more satisfactory and effective in use.

Third. Consists in a series of signaling stations or posts dividing the entire road into blocks, and each post is provided with two distinct sets of signals, one consisting of semaphores for each direction, also provided with illuminated night-signals to be operated in connection therewith, and the second a verifying-signal, visible



MEANS FOR SUSPENDING ELECTRIC LIGHTS. 314,976.

both day and night, operated from either direction, and acting as a signal whenever seen. The first-mentioned set consists of four semaphore arms or discs mounted on rods pivoted within the signal-box or station, so that they will swing outward into view. The four discs are divided into two sets, each comprising an advance and a rear signal, and the sets are, for convenience, located in separate compartments on opposite sides of the transverse axis of boxes or houses mounted upon posts or towers at suitable intervals along the roadway. These intervals may vary from one to several miles, in order that the signals may be placed at points most favorable for observation.

Fourth. Each signal station or post is provided with an automatically reversible electric motor connected with a source of electricity, and with a two-way reciprocating mechanism for actuating the signals at such posts or stations.

Conduit for Electric Wires; David Brooks, Jr., Philadelphia, Pa..... 314,791

Consists of an elevated conduit formed of woven wire and suspended in the manner of a road-bed of an ordinary suspension bridge.

Induction Coil; Frank E. Fisher, Detroit, Michigan.. 314,816

Consists in a fixed diamagnetic cover partially surrounding the core and a movable diamagnetic cover adapted to revolve on the core as an axis and gradually cover or uncover the same, while at the same time the poles of the core are not interfered with.

Mechanism for Operating Telephone Night Bells; Frank E. Fisher, Detroit, Mich., Assignor to the Detroit Electrical Works..... 314,817

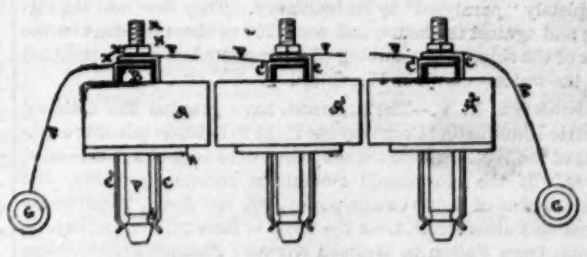
In telephone exchanges it is customary during the night, when a reduced force of operators is in attendance, to use a call-bell with each annunciator-board to notify the operators of a call, and this bell is disconnected during the day, when there is an operator in attendance at each switch-board. Consists of a metallic arm attached to each annunciator, but insulated therefrom, and all of said arms being electrically connected, a spring attached to but insulated from each of said arms in such a manner that its free end constantly tends to make electrical connection with said arm, and all of said springs being electrically connected mechanism, whereby the drop, when raised, forces the free end of the spring away from the arm, and a battery and electric bell in a circuit one end of which is electrically connected with one of said arms and the other with one of said springs.

Telephone Line Switch; Frank E. Fisher, Detroit, Mich., Assignor to the Detroit Electrical Works, same place..... 314,818

Consists of a fixed metal frame having attached thereto, but insulated therefrom, a ground connection and a binding post connected with the operator's telephone and of a metal piece movable in said frame, adapted to make contact with the ground connection when moved in one direction to the limit of its range of motion and to break this connection when correspondingly moved in the other direction, and having a lateral motion adapted to bring the same in connection with the binding post connected with the operator's telephone, and a spring plug adapted to engage with or be disengaged from said movable metal piece by the exercise of force sufficient to slide said metal piece in said frame.

Talking-Strap for Telephone Switch-Boards; Frank E. Fisher, Detroit, Mich., Assignor to the Detroit Electrical Works, same place..... 314,819

The operation of this invention is as follows: Suppose the switch-boards A each contain fifty lines, that the talking-strap shown is



TALKING-STRAP FOR TELEPHONE SWITCH-BOARDS 314,819.

No. 1, and that subscriber 51 on board A' wishes to talk to subscriber 150 on board A^2. Subscriber 51 calls the exchange, and, when in communication with the operator in charge of the board A' asks for No. 150. The operator forces plug on cylinder in such manner that the insulated strip comes in contact with spring C', and thus cuts off board A and all boards on the same side, because electrical communication between spring C' and cylinder P on board A' is broken, while the circuit between boards A' A^2 and all boards on the same side is not affected. The operator at board A' then calls up the operator at board A^2 and asks for No. 150 on strap 1. The operator connects the line of 150 with strap 1, using a plug, and so placing the plug as to break the circuit through the strap on the farther side from board A'. The first operator now rings up No. 150, and then connects the cord attached to plug D to the line of No. 51, when the two subscribers can talk together.

Telephone Transmitter; George M. Hopkins, Brooklyn, N. Y..... 314,841

Consists of a carbon electrode having a metal centre provided with a conical cavity, and an adjusting screw held by a yielding support and provided with a rounded end touching the wall of the conical cavity in the metal centre of the electrode, in combination with an electrode carried by the transmitter diaphragm.

Electrical Indicator; Frank J. Sprague, New York, N. Y..... 314,891

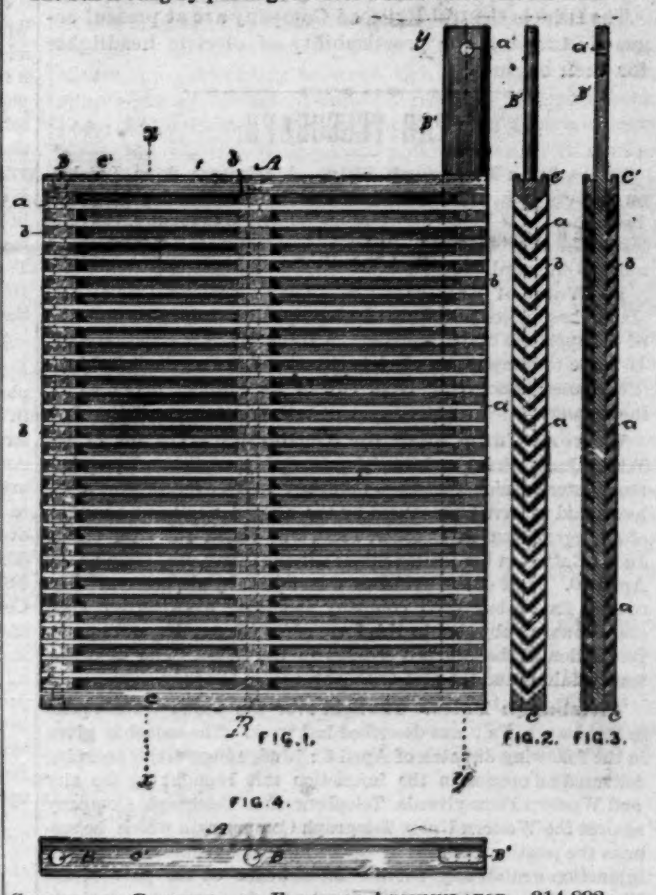
A small portion of the conductor is formed into a coil, and the soft-iron core is placed centrally within said coil and pivoted at its ends. Upon each projecting end of the core is placed an arm at right angles to said core, said arms extending in opposite directions and parallel to the conductor. One of these arms carries a needle or pointer, the end of which travels upon a scale. An adjustable weight or spring is attached to the core, opposing the movement of the indicating-arm. The arms attached to the core are magnetized from said core when current passes in the coil, and therefore tend to place themselves at right angles to the conductor in proximity to which they are. The weight is so adjusted that with no current passing the needle will stand at a certain selected point upon the scale. Then as the current increases the arm will move more toward a right angle with the conductor in a direction dependent on the direction of the current, and as it diminishes in the opposite direction. The extent of these movements is indicated by the needle upon the scale.

Secondary Battery, or Electric Accumulator; Eli T. Starr, Philadelphia, Pa., Assignor to the Starr Electric Storage Company, Camden, N. J..... 314,892

Consists of a battery-plate having substantially parallel strips a arranged horizontally and separated one from another by separating portions or washers b, so as to form free spaces between the strips for the circulation of the battery-liquid, said strips being united together by a separate connecting rod or rods B, or strips passing transversely through them.

Mechanical Telephone; Freeman C. Ludlow, Cincinnati, Ohio, Assignor to the Ludlow Telephone Company, Newport, Ky..... 314,946

The bell is rung by pushing the lever I backward. At the same



SECONDARY BATTERY, OR ELECTRIC ACCUMULATOR. 314,892.

time, in order to prevent the bell of the telephone where the person is signaling from ringing while he is signaling, he presses on the button, compressing the spring, and moving the clapper toward the box A, and placing it in a vertical plane lying between the box and bell. By pushing the lever I backward the free end of the lever E is pushed or forced against the back part of the box, the lower arm of said lever being depressed by the continuance of the force on the lever I, and its upper end or arm being raised or elevated until the notch e' is freed from contact or connection with the lever last named. This permits the spring G to come into play, and it throws the yoke D forward suddenly with some force, carrying with it the wire H. The wire H, by this movement, draws the corresponding yoke D in the other telephone at the other end of the line backwardly. When the yoke D is forced backward, the arm d' impinges against an arm, and through the intermediate mechanism throws the clapper rather smartly against the bell. The springs K in the sending telephone, assisted by the spring G in the receiving telephone, immediately return the parts to their proper positions, withdrawing the clapper from the bell and preventing it from dulling the sound of the bell by remaining in contact with it after setting it in vibration.

Means for Suspending Electric Lights; William H. O'Bierne, Fort Wayne, Ind., Assignor to the Star Iron Tower Co., of same place..... 314,976

A trussed lamp frame having a lamp D at one end and a counterweight E at the other is fulcrumed to a supporting frame B projecting from a mast A adjacent to its head. The lamp frame is swung by a wire and chain secured to the mast, and its inner portion rests on a support a at the top of the mast. The lamp frame and mast are provided with insulators a^2.

In practice the tube c and the supporting frame are made of gas-pipe, the lengths being connected by pipe-joints. The said parts are made tubular for the sake of lightness; but, if desired, solid rods of iron or other metal may be used.

The different parts may have any convenient relative proportions, but, as constructed, the mast is thirty feet high, the lamp-frame thirty-one feet long, and the fulcrum four feet from the end of the mast and ten feet from the weight, thus making the lamp twenty-five feet from the end of the mast.